Hilda Hawkey

Thoughts

YOU are thinking and feeling about a thousand things in these years in which you are laying the foundations of a world. What a solemn thing that is to say, and yet it is true that every one of us, in the days of our youth, is building a world, as certainly as he who builds up stones and crowns them with towers and domes. We come into a world that is open to receive us; for a few short years we live in the world as we find it; but soon, perhaps almost sooner than we know, we are making our own world, carving our own way, shaping our own thoughts, controlling our own destinies.

What shall we take, and what shall we reject? The things we put into our pockets may be as nothing, though they may be made of gold; but the things we put into our minds are all the world to us, though they fall from the skies or rise from the valleys or pour out upon us from the hills, and cost us nothing. *We are what we think.* We are as old as we feel, as rich or as poor as our imaginations. We are as strong as our faith or as weak as our fears. It is these things that make up life for us; it is your *mind* that makes your world, and *your mind is what you make it.*

(*By Arthur Mee*)

'Her Son' is the name of this famous statue by Nellie Verne Walker
The original is in the Art Institute, Chicago

COMPTON'S PICTURED ENCYCLOPEDIA

VOLUME 8

To inspire ambition, to stimulate the imagination, to provide the inquiring mind with accurate information told in an interesting style, and thus lead into broader fields of knowledge—such is the purpose of this work

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CHICAGO
ILLINOIS

HERE AND THERE in Volume Eight

AT ODD TIMES when you are just looking for "something interesting to read," without any special plan in mind, this list will help you. Divided as it is into broad groups, it offers a fascinating variety of subjects for selection. With this as a guide, you may wander through storyland, visit far-away countries, meet famous people of ancient and modern times, review history's most brilliant incidents, explore the marvels of nature and science, play games—in short, find whatever suits your fancy of the moment. This list contains, however, only a small proportion of the articles in this one volume, and is not intended to serve as a table of contents, an index, or a study-guide. For these purposes consult the Fact-Index and the Study Outlines at the end of this work.

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KEY TO PRONUNCIATION

Pronunciations have been indicated in the body of this work only for words which present special difficulties. For the pronunciation of other words, consult the Fact-Index in the last volume. Marked letters are sounded as in the following words: *cāpe, ăt, fär, fȧst, swạt, fạll; mē, yĕt, fẽrn, thêre; īce, bĭt; rōw, nŏt, fôr, wȯn, dọ; cūre, bŭt, düne* (French *u*), *rude, full, bûrn; ḡo, ġem, cañyon, Jeaṅ*, (nasal); G = German *g* (guttural); K = German *ch* (guttural).

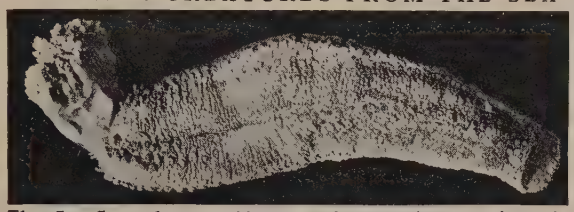
SEA-CUCUMBER. If a Chinese cook says he will have "cucumbers" for dinner, don't be too sure that you know what he means. He may be planning one of his favorite native dishes made of "sea-cucumbers," sometimes called *trepang* or *bêche-de-mer*. "Sea-cucumber" or "holothurian" is a term applied to a low class of marine animals, whose bodies are composed of elastic muscular tissue, covered with warts or spines, and which generally resemble in shape their vegetable namesake. At one end of their body is the mouth surrounded by small sensitive tentacles with which their food is gathered. The common sea-urchin and starfish, found on almost all seacoasts, belong to the same group (called Echinoderms) as the sea-cucumber, but the latter lacks the characteristic covering of living plates. (*See* Starfish and Sea-Urchins.)

Trepang is considered a great luxury among the Chinese, Malays, and other Eastern peoples, and its gathering and preparation for the market is a flourishing industry among the islands of the Pacific, even to the California coast. White men who have eaten sea-cucumber soup declare it to be delicious. The trepangs, which grow from 10 to 15 inches long, are gathered from coral reefs, and are boiled, dried in the sun, then over a fire, which gives them a smoky taste. The highest grade has been sold for $1,000 a ton.

SEA-HORSE. With a head shaped like that of a tiny prancing charger and a tail like a snake's, there is little about the "sea-horse" to suggest that it is really a fish. Nor do its habits follow those of the finny tribe. At times it swims upright through the water with the aid of its single back fin, but usually it remains at rest with its tail curled around a bit of seaweed to keep from being swept away. Thus anchored, it looks like some strange pigmy dragon out of a fairy tale.

But perhaps the most peculiar thing about these creatures is the method of caring for their eggs. The male carries them around in his "vest pocket," a sort of pouch like a kangaroo's, until they are hatched. And even after they are hatched out, the young take refuge in the paternal pouch when alarmed, continuing this practice until they are old enough to forage about for themselves.

STRANGE CREATURES FROM THE SEA



The Sea-Cucumber got his name because he sometimes is large and fat enough to look like his vegetable namesake, but more often he looks like a giant caterpillar or worm.

If the Sea-Horse were larger, he would certainly cause alarm wherever he appeared, but fortunately the common sea-horse of the North American coast is only from three to six inches long.

Sea-horses are found in small numbers in nearly all of the warm and temperate seas. They belong to the pipefish family, but their swimming powers are feeble. Clothed in bony plates and spines, and closely resembling in color the weeds among which they dwell, they are able despite their helplessness to escape their many enemies.

A near relative of the sea-horse, called the "sea-dragon," is a native of Australian waters. It is covered with countless flaps and appendages which give the exact appearance of seaweeds. This curious fish, like the sea-horse, and all the other members of the pipefish group, has a slender snout through which it sucks up its food, consisting of small sea creatures and the eggs of other fishes.

There are some 40 species of sea-horses, ranging in size from 2 to 12 inches. The common sea-horse of the Atlantic coast of North America reaches a length of about six inches. Scientific name of this species, *Hippocampus hudsonius*.

The ORIGINAL OWNERS *of* SEALSKIN COATS

But the Fur Seal is not a true Seal, and the true Seal has no fur coat. This article tells you how to distinguish the various kinds of Seals, and their cousins the Sea-Lions and the curious Sea-Elephants.

A HOODED SEAL

SEAL. The animal from which is obtained the valuable fur called "sealskin" is not a "true" seal, but a sea-bear! True seals (which belong to the family *Phocidae*) do not possess external ears, and their limbs are more highly modified than in the fur seal. Their hind limbs, or flippers, are stretched backward and closely united together, and are of no use in walking on land, which is accomplished by a wriggling or shuffling action of the body, at times assisted by the fore limbs. The fur seals and their relatives (family *Otariidae*), on the other hand, both have external ears and can walk and run on all four feet, and thus are nearer to the land-animal type from which they developed. All seals are mammals. One or occasionally two young are produced annually, and these are at first covered with a coat of thick soft nearly white fur, which in some species is retained for two weeks or more. The young do not take to the water until this fur is shed, when they are taught by the mother to swim—often quite reluctantly!

THE GRAY SEAL OF THE ATLANTIC

This variety of Seal is known only in the North Atlantic Ocean. It is one of the largest species, often reaching a length of eight feet. In color it is a yellowish gray, the back being somewhat darker than the belly, and is often spotted with darker gray or brownish-black splotches.

The common harbor or "leopard seal" (so called on account of its spots) is the most widely distributed and best known of the true or hair seals. It is found along the European shores of the Atlantic and Arctic oceans, as well as along the shores of North America, and it ranges south in the North Pacific to the coast of Japan. Its usual haunts are the rocky points of the mainland coast and islands, but it has been known to ascend the St. Lawrence to Lake Champlain and Lake Huron, and the Yukon several hundred miles from its mouth. It does not migrate, but frequents the pack-ice along shore in winter. It is not as social in its habits as the fur seal, but small herds collect on islets during the breeding season. The young are born in early spring, and the mother is devoted to them, showing deep anxiety if danger threatens.

The flesh and blubber of this seal are valued by the Eskimos. The skins are used for clothing and in making rawhide nets. The harbor seal is said to be intelligent, docile, and affectionate when tamed. It shows little fear of human beings unless hunted, when it becomes shy and wary. This seal is small, attaining a length of only five or six feet, and therefore is not hunted extensively for commercial purposes.

The Greenland seal, also called the "harp seal" or "saddle-back," because of the striking color pattern of its back, is also a true seal. This is a larger species, old males weighing as much as 800 pounds. It occurs in the northern waters of both hemispheres. In North Atlantic waters it migrates southward with the ice-pack in autumn to the coast of Newfoundland and returns northward with the pack after the breeding season in spring. It also is extremely social and gathers in large numbers on the pack ice off Newfoundland, during March and April, to breed. Originally there were enormous numbers of these animals, and the value of their skins and blubber made them the basis of a great industry. Hundreds of vessels were sent out from American and European ports, and nearly a million seals were killed during each breeding season. This terrible slaughter has so reduced their numbers that now little sealing is done. This is well, because many human lives were lost in sealing, hundreds of men being miserably frozen on the drifting ice or drowned with their sinking ships.

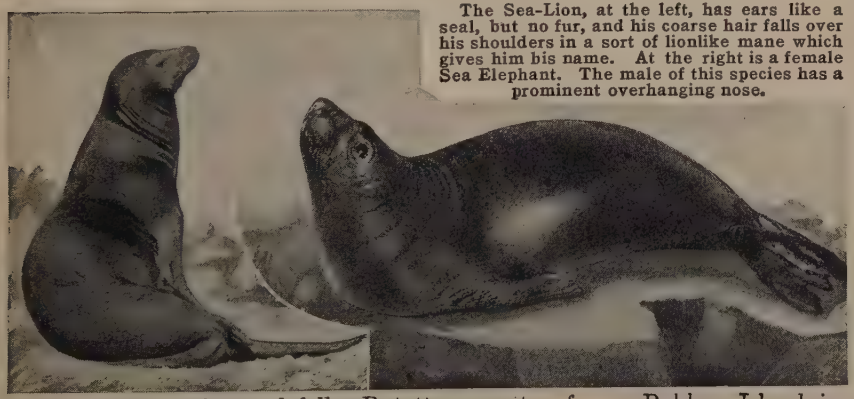
For any subject not found in its alphabetical place see information

A SEAL ROOKERY ON THE PRIBILOF ISLANDS

This is a part of the largest remaining herd of Fur Seals, including about 600,000 individuals, which make the Pribilof Islands their summer home. Ages ago probably all seals were land animals, but now they come to land only to breed and rear their young. Each year, about the first of May, the adult males land, and pick out their places on the shore. Late comers are driven away and forced to seek less desirable locations. A month later the "cows" begin to arrive.

The broad-banded markings of the male "ribbon seal" make it the most strongly characterized of the true seals. Its home is in the North Pacific. It has been captured about the shores of Kamchatka, and on the coast of North America south of the Yukon delta and from Cape Nome to Bering Strait. Because of its attractive markings, the skin of the male is greatly prized by the Eskimos, who hunt it in their *kyaks* in spring and fall. But the scarcity of the ribbon seal, and its solitary habits, serve to safeguard it from the dangers to which its more social relatives are exposed.

COUSINS OF THE FUR SEAL



The Sea-Lion, at the left, has ears like a seal, but no fur, and his coarse hair falls over his shoulders in a sort of lionlike mane which gives him his name. At the right is a female Sea Elephant. The male of this species has a prominent overhanging nose.

This is about the Fur Seal

The "fur seals" that yield the beautiful sealskin have external ears and are so closely related in structure to the bears that they are often called "sea-bears." In habits and general appearance, however, they resemble the true seals. Their limbs are longer and of more practical use on land, and for a distance of 100 feet they can run faster than a man can walk.

The young fur seals at first possess a woolly black coat, later changing into the soft brownish fur which makes their skins so much prized for women's wraps and coats.

There are two groups or genera of fur seals—the one (called *Arctocephalus*) whose species formerly inhabited the Southern Hemisphere, off the Pacific coast and islands of South America, and the waters of Australia, New Zealand, and South Africa, but which have now practically all been killed off; and the other (called *Otoës*) which is confined to the waters of the North Pacific. There are now three different herds of these fur seals of the North Pacific. The smallest, which numbers perhaps 10,000 individuals, breeds on Robben Island in the Sea of Okhotsk and the nearby Kuril Islands, and migrates into the Sea of Japan; this herd is controlled by the Japanese government. The second herd breeds on the Commander Islands in Bering Sea, and is under the control of Russia. The third and largest herd breeds on the Pribilof Islands, off the Alaskan coast, and is under the control of the United States. It migrates southward through the passes of the Aleutian Islands, and returns along the western coast of North America

traveling from southern California to the Bering Sea. When the United States purchased Alaska this herd probably numbered 2,500,000 seals, but it has now been reduced to about 600,000.

In the breeding season, a visit to the fog-shrouded Pribilof Islands, in the isolation of Bering Sea, over 200 miles from the Alaskan coast, is an interesting experience. The full-grown "bulls," seven years or more old and weighing 400 to 500 pounds, arrive first, early in May, and select the places for the "rookeries" on the bowlder-strewn beaches. Later the "cows" arrive, and take their places in close packed herds or "harems" of varying sizes (up to 100), each herd about a bull. There is much fighting among the bulls, and the young "bachelor" males are forced to herd by themselves on nearby but separate beaches. It is these "bachelor" males alone that are permitted to be killed under regulations of the United States government. The young are born soon after the "cows" arrive, and within a week or so the mother goes off to sea to feed, returning at gradually lengthening intervals to nurse her young (called a "pup"). The bulls keep jealous watch over their herds and young without once leaving the beach or taking food, from May until August. Then they too put out to sea in search of food, chiefly of squid and fish, of which seals consume enormous quantities.

A MOTHER SEAL AND HER YOUNG

In this group of Fur Seals, you can see clearly the powerful flippers which enable them to walk on all fours, unlike the true seals.

During the first season the young subsist entirely on their mother's milk; before the fall migration begins the young are taught to swim. All seals are extremely social, and from the ages of one to four years are very playful. They follow one another about on the beaches in evident enjoyment, pulling and tugging, or diving and then leaping high into the air. Their chief enemy, aside from man, is the killer whale. During the early years of the fur-sealing industry, seals were killed in a most indiscriminate manner, both on the "rookeries" or breeding places, and in the open sea, females as well as males being taken regardless of age or condition. Japanese, Russians, Britishers, and Americans joined in the slaughter at sea, although the killing on the Pribilof "rookeries" was carefully limited by government regulations. The number of seals became so greatly reduced that the United States took measures to stop "pelagic" or open-sea sealing, and thereby became involved in a controversy with Great Britain. The dispute was finally submitted to arbitration at Paris in 1893, with the result that pelagic sealing was prohibited in a zone of 60 miles' radius around the Pribilof Islands, and it was agreed that no seals might be killed anywhere between May 1 and July 1. By treaties of the United States with Great Britain, Russia, and Japan, in 1911, *all* sealing on the high seas was prohibited for 15 years. In 1912 Congress passed a law that no fur seals should be killed on the Pribilof Islands for five years except as food for the natives. As a result of the foregoing measures the herd, which before was threatened with extinction, is now increasing in numbers.

Since 1909 the United States has directly controlled and managed its fur seal herd, taking over the rights of killing and marketing which before had been leased to a private company. The skins after dressing, dyeing, and machining are disposed of at the St. Louis fur auctions, where the better class of skins sell for from $50 to $100 each. The revenue obtained by the government since 1867 from the fur seal herd alone is already several times the $7,000,000 that it paid for the whole of Alaska, and in time it bids fair to equal if not to exceed that amount every year.

Sea-Lions and Sea-Elephants

The sea-lions are eared seals, like the fur seals, and are the largest of the group; but their hairy coats have no value as fur. The northern or Steller's sea-lion (*Eumetopias stelleri*), which frequents the shores of the North Pacific, is the best known. It is an enormous creature, sometimes attaining a length of 12 feet and weighing over 1,800 pounds. In former days the natives of the Pribilof Islands made raincoats out of the lining of its intestines, and constructed boats by stretching sea-lion skins over wooden frames.

The California sea-lion (*Zalophus californianus*) is a much smaller animal, only 7 or 8 feet long. It is often seen on the rocks of San Francisco Bay, along with Steller's sea-lion; but it is more numerous on the southern Californian and Mexican coasts, and a related form is found in Australian waters. Because of its intelligence this sea-lion is captured and trained for menagerie purposes. Among the Galapagos Islands and on both the Atlantic and Pacific coasts of South America a third sort of sea-lion is met with, *Otaria jubata*.

But the monster of the seal family is the "sea-elephant" or elephant seal, which unlike the sea-lions is classed with the true seals because of its lack of external ears. Two species are known, one on islands on the borders of the Antarctic Ocean, the other

on the Pacific coast of Upper and Lower California. Their name is derived from the possession in the male of a long flexible snout or trunk which when relaxed hangs 9 or 10 inches below the muzzle.

The southern sea-elephant (*Macrorhinus leoninus*) is considerably larger than an elephant, old males measuring over 20 feet in length, with a circumference of 12 feet about the chest. At the beginning of the 19th century they were found in great herds in Juan Fernandez, the South Shetland, Falkland, and other islands about Cape Horn; but since a single individual would yield 20 gallons of excellent oil, hunters have greatly reduced their numbers. They move with ease and grace in the water, and emit a roar something like the bellowing of an ox. On shore they are sluggish and it is said they will permit a man to walk up and touch them without showing signs of fear. When attacked they become panic-stricken and escape is difficult because of their clumsy bodies and lack of other limbs than the flippers. During the breeding season the males have furious combats among themselves, a whole harem of females being the prize that goes to the victor. The proboscis or trunk serves no useful purpose, as does the trunk of the elephant. The northern sea-elephant (*Macrorhinus angustirostris*) was formerly common on the Pacific coast, but is now extinct there except for a herd of about 150 on the small island of Guadalupe, off Lower California.

Sea-serpent. The early literature of many nations abounds in stories of sea-serpents, many of which are traceable to the giant squid. For these are the only known animals whose arms can be made to assume the form of a serpent. The expanded end of one of its two longest tentacles, when held just above the surface of the water, may easily be mistaken for the head, and the wavy tentacle itself, for the body of the serpent.

The supposition that giant squids are the sea-serpents of myth and fable is supported by the fact that these squids are found in the regions in which sea-serpents are said to have been seen. Sailors and fishermen have given vivid descriptions of these creatures agitating the ocean so that "the waters run like a mill"; or of their spouting water like a whale; or raising a frightful head to snap one man out of a boat without hurting the others. Some descriptions credit these creatures with the possession of staring blue eyes, bright and big as pewter plates. Norwegian sailors have affirmed that this serpent, or *kraken*, was able to lay hold of the strongest man-of-war and pull it down to the bottom of the sea. In the year 1680, it is said, a *kraken* came into the waters that run between the rocks and cliffs of the shore near a certain parish in Norway. Extending its long arms it caught hold of some trees standing near the water and entangled itself in some openings or clefts in the rock, and stuck so fast therein that it could not work itself out, and, after a terrific struggle, perished on the spot.

Stories of sea-serpents are current among fishermen on the Grand Banks of Newfoundland to this day, some of which seem quite reliable and indicate that the giant squid may at times be a source of danger to man. According to one of these stories, two fishermen were out in a small boat about nine miles from St. Johns when they saw an object in the water which they thought was the débris of a wreck. One of the men struck at it with his oar, whereupon the object immediately reared a parrot-like beak with which it struck the boat. It then entwined the boat with two huge, gray arms. The men cut these arms with an ax, and the creature ejected an immense quantity of inky fluid which darkened the water for 200 yards. It was observed that the creature was the same shape and color as the common squid, but about 50 feet long and five feet in diameter. (*See* Cuttlefish, Squid, and Octopus.)

Seattle, Wash. Coming into Seattle's harbor at dusk, you enter an enchanted land. Before you stretch ten miles of shadowy water front, with countless wharves and warehouses poking giant fingers out into the briny waters of Puget Sound. All about you dim ghostlike ships from all parts of the world grope noiselessly to their port, where they load or unload their countless wares. Here a great Alaska liner is preparing for a voyage to the northern glacier land; next it lies a majestic vessel just arrived from Liverpool by way of the Panama Canal; farther on you see ships from China and Japan with cargoes of tea and shining silk. And in the distance, to the west and east, tower mountains—vague, jagged, snow-tipped mountains, these Olympics and Cascades—endlessly sentineling this twilight wonderland.

Situated on one of the best natural land-locked harbors in the world and the gateway of the shortest route to the Orient and to Alaska, it is no wonder that Seattle, already one of the chief seaports on the Pacific coast, is fast becoming one of world importance. Eager to rival New York in its docks and shipping, the city has spent millions of dollars on harbor improvements. The most notable of these is the $8\frac{1}{2}$-mile canal which connects the salt water harbor with the fresh waters of lakes Union and Washington, thus giving Seattle an unrivaled fresh water harbor, and increasing her water-front from 40 to 140 miles. This harbor also has the advantage of giving ocean vessels a fresh water bath that rids them of barnacles.

Seattle is an important gateway by land, as well as by sea, for it is the terminus of six transcontinental railroad lines. Because of this excellent transportation and because of the inexhaustible water and electric power furnished by many small nearby streams, Seattle is the most important manufacturing city in the Pacific Northwest. Shipbuilding is one of the leading industries; others are flour and rolling mills, foundries, iron works, woodworking, shingle and lumber mills, meat packing, and fish canning. Seattle is also the greatest marketing center on the Pacific coast for fruit, vegetables, and dairy products,

as it is the base of supplies for the logging camps, lumber mills, and mines of Washington, Alaska, and the whole northwestern territory. Most of the gold from Alaska and the Yukon region comes here to the United States assay office.

As proudly located as Rome on her seven high-crested hills, Seattle has had to sacrifice some of her beauty to convenience. She has regraded several of her picturesque hills by a hydraulic process—literally washing them away! But the city can never lose the superb views which meet the eye at every turn.

Seattle was named for an Indian chief. The first white settlement took place in 1852, and in 1889 a disastrous fire occurred. The city became the outfitting point for Alaska and the Yukon region when gold was discovered in 1897, and from that time on it developed rapidly. In 1909 the Alaska-Yukon-Pacific exposition was held in Seattle. The University of Washington occupies 355 acres within the city limits.

Seattle's mild though rainy climate and her pure water supply from the Cascade hills make it very healthful, with one of the lowest death rates in the world. Population, about 320,000.

Sea-urchin. This small sea animal, with its spiny shell, is closely related to the starfishes. There are many varieties of these interesting creatures found among the rocks along the seashores and on the ocean bottom. The common green sea-urchin (*Strongylocentrotus drobachiensis*) of the rocky New England and Pacific coasts is a round cushion-shaped creature with a shell of beautifully patterned limy plates underneath its thicket of spines. The smooth flat sand-dollar (*Echinarachnius parma*) is another familiar form found on sandy shores and admired for its curious markings. (*See* Starfish and Sea-Urchins.)

Seaweed. A great floating meadow of seaweed—the famous Sargasso Sea—almost as large as a continent, lies in the North Atlantic Ocean, massed together by winds and ocean currents from the Caribbean Sea and Gulf of Mexico. It is a tangled fairy forest, the resting place for wandering albatross and petrel, and the home of tiny fishes, mollusks, crabs, jellyfish, sea worms, and other many-colored deep-sea creatures, which dart in and out, reminding us of Coleridge's lines—

> Blue, glossy green, and velvet black,
> They coiled and swam; and every track
> Was a flash of golden fire.

Through such masses of seaweed the ships of Columbus sailed for two weeks on his first voyage to the New World, and other enormous floating islands of seaweeds exist in the Pacific and Antarctic oceans. They are composed chiefly of the variety called "gulf weed," a long many-branched plant buoyed up by little air-bladders that look something like grapes. Many other kinds of seaweed are found all over the world, growing in both fresh and salt water. They are blue-green, green, brown, and red; and range in size from the little blue-green slimes found on ponds to the giant kelps, sometimes 150 feet long, with tough, leathery, rootlike branches.

They are useful as well as interesting and beautiful—these plants of the lakes and ponds and rivers and sea. Not only do they form breakwaters that prevent the wear and tear of waves on the coast, and sometimes make natural harbors; not only do they serve the useful purpose of throwing off oxygen and keeping the water pure; but they also form the real basis for ocean life, since the larger water creatures live on the smaller ones, which feed upon seaweed.

SOME OF THE VARIED FORMS OF SEAWEED

1. The *Iridea edulis*, better known as Hide-Weed. 2. Carrageen or Irish Moss, an edible variety of the red seaweeds. 3. Rock weed (*Fucus vesiculosus*), one of the brown seaweeds. 4. Sea Lettuce (*Ulva latissima*), a green weed. 5. Deadman's Hand (*Laminaria digitata*). 6. Wingweed (*Laminaria esculenta*). Both the Deadman's Hand and the Wingweed belong to the group known as kelps.

Kelp ash was formerly an important source of the alkalis used in manufacturing soap and glass, and the chief source also of iodine; but nowadays its chief value is as a fertilizer, since its rich potash content makes it a valuable enricher of worn-out soils. Many varieties of seaweeds, such as "Irish moss" or carrageen, are edible, containing a considerable proportion of gelatinous nutriment. Cattle and horses used to rough pastures thrive on it, and we also like it in blanc mange, and in jellies and soups. Many thousands of pounds of Irish moss are gathered at low tide along the rocky coasts of Ireland and Massachusetts Bay. When the tide rises the people go out in small boats and gather in the moss with rakes. Sometimes seaweed is used by upholsterers for stuffing mattresses, chairs, and couches; sometimes it is used in the manufacture of paper; sometimes it makes a kind of gelatin; and sometimes all sorts of little dolls and baskets and trinkets are formed out of dried kelp. The gigantic kelps along the northwest coast of America were once used by the natives for ropes, and the huge bladders, as large as kegs, served as water bags.

The term seaweed includes the simple kinds of algae, but not aquatic mosses, liverworts, fernworts, and flowering plants (*see* Algae).

Secretary Bird. As snake killers, secretary birds are of great value in their native home of South Africa. They are protected by law and farmers often keep them about their premises to destroy vermin, for their diet includes frogs, insects, lizards, and small tortoises, as well as snakes.

Secretary birds (*Serpentarius secretarius*) were perhaps so called because of a tuft of quill-like feathers projecting from the back and sides of the head, making the profile view resemble that of a clerk or secretary with a number of quill pens behind his ear. They are also called "serpent eagles." The birds have very long legs and are about four feet high, with a tail that reaches the ground. The beak is strong and hooked, and the plumage a clear gray. They run with the speed of a horse, and when forced to do so will take to the air and fly to considerable heights. They build bulky nests in trees or bushes. The secretary bird forms a family by itself, related to the vultures.

MR. SECRETARY

The Secretary Bird is not as mild as his name might indicate. This one is toying with a snake, a delicacy of which the bird is very fond.

Sedan, France. It was Nov. 7, 1918, four days before the armistice that ended the World War. American troops of the First Army, by the victorious battle of the Argonne, had cut the German communications and brought the town of Sedan under their guns. Now the doughboys of the "Rainbow Division" stood lined up by the roadside, ready to march across the Meuse and carry the Stars and Stripes into the town.

But before they entered, they sent ahead of them a column of French soldiers. The town of Sedan had for many years stood to France for a symbol of disaster. There, 48 years before, the last desperate battle of the Franco-Prussian War had been fought, in which Napoleon III and 86,000 men surrendered to the Germans. So by a fine act of courtesy the Americans allowed the French to enter Sedan first; and as the poilus in horizon blue passed the boys in khaki, the soldiers of both nations cheered and cheered again because of the wiping out of an old stain and the avenging of a nation's honor.

Sedan is a frontier fortress of France, on the right bank of the Meuse, 64 miles northeast of Reims. Within its stern fortifications in times of peace it manufactures cloth and machinery and flour, like a man in armor at a spinning wheel. Its name too is familiar in the name "Sedan chair," a sort of chair invented here to be carried on the shoulders of bearers, and once much used in Europe. The city has had a varied history since it was founded in the 14th century. Population, about 20,000.

Sedge. The sedges are a large family of plants closely resembling the grasses and rushes, and are found thickly bunched in damp places. There are thousands of species, about 200 of which are found in North America. The sheath which enfolds the triangular stem is solid, while the grasses usually have the stem sheath split on one side. This difference is often the only feature by which the two can be distinguished. The spikelets of sedge flowers are small and inclosed by one scale instead of two, as is the case with grasses. In general the sedges are of little use to man, the coarse fodder being rejected by animals on account of the solid dry stems. The tubers of a few species are good to eat, while the fragrant roots of another are made into perfume. The generic name of the sedges is *Carex*.

Seeds and Spores. Travelers in the West Indies are sometimes startled by a report like a pistol-shot, followed by a volley of large seeds rattling through the surrounding vegetation. And if one of the seeds should strike them at close range it would leave a mark they would be likely to remember the rest of the day. This is the effective way the sand-box tree, or "Monkey's dinner bell" (*hura*), takes to scatter its seeds so that when the new plants grow up they will not be crowded together on exhausted soil. Many other plants have such "sling-fruits," which burst violently when they are ripe and jerk the seeds out to a considerable distance. Examples are the wood-sorrel and pansy.

This explosive method is only one of the ways by which plants sow their seeds in fresh soil. Many

HOW PLANTS PROVIDE FOR THEIR YOUNG

Plants have scores of ingenious ways of scattering their seeds so that the next generation may start life in fresh and unexhausted soil. Some plants and trees, like the Carline Thistle (1) and the Striped Maple (2), trust to the wind to carry their seeds to fertile ground. The Monkey's Dinner Bell (3) is more energetic, perhaps because it lives in the warmer parts of South and Central America; its seeds are contained in separate capsules which explode with a loud report and are shot far away from the seed cluster. The Lappa or Burdock seeds (4) spread by sticking to animals, and the Bayberry (5) attracts birds which carry away the seeds sticking to their beaks or feathers.

seeds, or the fruits inclosing them, are especially adapted for transport by wind. The fruit of the basswood has a wing which acts like a parachute, sailing along with the breeze and carrying the fruit with it. Dandelions and thistles grow tufts of soft hairs, which float on the merest breath of air. Others have wings circular or paddle-shaped, like the elm-fruit or the "keys" of maple, ash, and tulip tree, which twirl in the air or fall like a stone according to their design. Other seeds are so light that they are blown about like dust. Again, the seed-heads, or even the whole plant, as in the tumble-weed, twists itself into a globular basket, inclosing the seed-pods, and rolls before the wind, carrying and scattering the seed broadcast over the countryside.

The fruits of many plants growing in or near the water are provided with life-preservers in the shape of air-filled coats, or bladder-like floats, to enable them to travel on the current. The tough shell of the coconut is water-tight and buoyant, and it drifts in the sea, uninjured, from tropical beach to beach.

Even birds and animals are compelled to act as seed carriers. Grasping hairs, barbed and sharp and hooked spines, fasten seeds to their coats "like burrs," or are trodden upon, and often are carried for long distances before the annoyed beast can rid itself of them. Mud dried on the shanks of water-fowl has its quota of small seeds.

It is to attract hungry creatures, especially birds, that seeds are often sunk in the flesh of luscious gaily

colored fruits. Sometimes this is so sticky that the seeds are smeared on beaks to be wiped off and planted far away, as in the mistletoe; sometimes the seeds, as in the case of cherry pits, have coats so hard as to pass through the creature's digestive organs uninjured. On the other hand, these plant friends must be kept from attacking the young seeds and carrying them off before the proper time. This is done by many effective devices. The unripe flesh of edible fruits, for example, is too green and hard or sour to tempt; the thick husks of walnuts are filled with tannin; citrus fruits bear burning oils in their skins. Other fruits, or the bracts inclosing them, are armed with sharp prickles and spines, as we are painfully aware when we handle a chestnut-burr or a thistle-head. Moreover, the food provided within the seed for the infant plant is often rendered unpalatable by bitter and curious flavors, some of which we have come to like, as those of chocolate and coffee. Nutritious starches and useful oils and drugs are found there also, and even poisons. We must never forget that the little seeds of the spiked thorn-apple can kill.

To get an idea of how a seed is constructed, remove the coat from a bean or a pea. At once you will notice that the "embryo" or young plant within has two main parts which you can easily separate. These are called seed-leaves or "cotyledons," and their purpose is to provide nourishment for the young plant when it first emerges from its seed-coat and before it has had time to unfold its leaves and push its roots into the soil to secure its own food. Besides the cotyledons the embryo has other smaller parts which will develop into the roots, stems, and leaves of the mature plant. In some plants the cotyledons are too small to provide much nourishment to the young seedling. In those cases nourishment is furnished by the "endosperm," a starchy tissue which surrounds the embryo. Beans have no endosperm, but corn seeds show endosperm as well as embryo. If you examine a kernel of corn you will also be able to see that the little corn embryo has only one cotyledon instead of two. This difference is so important that botanists classify all plants with inclosed seeds (angiosperms) according to the way their seeds are made. Those with two or more seed-leaves are called "dicotyledons"; those with only one are known as "monocotyledons."

Difference between Seeds and Spores

Only the true flowering plants, the "spermatophytes," produce seeds. Most of the so-called "flowerless plants" or "cryptogams" reproduce by means of spores, which are merely little cells set apart for reproductive purposes. Unlike seeds, spores do not contain any young plant or embryo. In earlier days it was a favorite joke to send youngsters on Midsummer-Night's Eve to hunt for fern-seeds, by telling them that if the lucky finder put them in his shoe he would become invisible—as invisible as the elders thought the seed was, for they did not know that spores, hidden in the brown patches, or *sori* on the back of the frond, take the place of seeds. One type of spore, formed by the splitting of a cell in the parent plant, is called "asexual" and is borne in sporangia. The other type includes "zygospores" and "oospores" formed by the union of two sexual cells, in the latter case dissimilar and known as male and female cells, but having also many other names according to their origin and family, as well as many shapes. Some of the male cells can swim by means of hairlike tails, or "cilia," which thrash about. When an asexual spore from a fern germinates, it spreads into a thin green sheet, called a "prothallium." On these prothallia arise small structures, flask-shaped, known as "archegonia," in which lie the female or egg cells, which are to be fertilized by the ciliated male cells escaping from other receptacles called "antheridia," carried by drops of rainwater. The fern plant which we know springs from the fertilized egg-cell and itself raises asexual spores. This roundabout process is called the "alternation of generations" and is followed by other cryptogams as well. (*See* Ferns; Fungi; Liverworts; Moss.)

SEINE (*sān*) **RIVER.** Foremost in historic interest of the rivers of France is the Seine, made world famous through the development of Paris on its banks. It rises from six little springs in a wooded rocky dale among the hills of the old duchy of Burgundy in eastern France and, after winding and twisting its way northwestward through a course of 482 miles, falls into the English Channel between the ports of Honfleur and Havre. In a direct line the source of the Seine is only 250 miles from its mouth, but the river doubles back and forth, curving and recurving upon itself until it consumes almost twice that distance. Gliding beneath the shade of overarching willows and tall poplars, it flows through a beautiful country rich in memories of bygone times, and abounding in relics of present and departed greatness. Battle-grounds of the Romans, the Vikings, and the Normans, ancient palaces of kings, grim feudal castles and medieval monasteries, intermingled with stately mansions of today and widespreading forests, lie along its course. Before reaching Paris about 230 miles from the mouth, it passes such famous cities as Melun and Fontainebleau, while below the great metropolis St. Denis, St. Germaine, and Rouen are situated on its banks.

The Seine near its source is a puny rivulet that sometimes in summer becomes quite dry. Sustained by small tributaries, however, it increases to a vigorous brook, and farther on, as it receives in turn the waters of the Aube, the Yonne, the Oise, and the Marne, it develops into one of the four important rivers of France, furnishing water-power for numerous large industries. It is navigable for small vessels for some distance above Paris. The low elevation of the hills which bound its basin makes it comparatively easy, moreover, to connect the Seine and its tributaries, by means of canals, with the Somme,

the Scheldt, the Meuse, the Saône, and the Loire. Deep dredging from its mouth to Rouen, a distance of about 50 miles, has made that city a seaport and has reclaimed 28,000 acres of land. In the World War the farthest advance of the Germans, in 1914, touched the Seine about 100 miles east of Paris.

Selenium. A photographer in New York takes a picture of a passing parade, and hastens to his dark room. Here he prepares a print, and takes it to a nearby laboratory, where it is placed in a curious machine. The machine commences to work—and at the same moment another machine in San Francisco with which it is connected by telegraph starts also. When both machines stop, the second has produced a duplicate of the picture which was placed in the first. The two machines have "telegraphed" the picture taken by the photographer.

Such marvelous achievements are made possible by a curious property of the element selenium. This substance conducts electricity—and the more intense the light which falls upon it, the better conductor it is. In order then to "telegraph" a picture, it is only necessary to expose it bit by bit to a beam of light, and then to make this light fall on a piece of selenium sometimes called the "eye." When a dark place comes in the picture, only a little light falls on the selenium and its conductivity is low. A light spot increases the conductivity. These varying currents are transmitted to a lamp in the receiving machine, and its varying light is allowed to fall on a plate which is being moved by machinery in exactly the same way that the original picture is moving. The spots varying light and dark build up a duplicate of the original picture. The method has even been adapted with some success to transmission by wireless instead of telegraph.

Selenium was discovered in 1817 by the Swedish chemist Berzelius. Ruhmers, a German scientist, used selenium in making a telephone with which he could talk over a ray from a searchlight. It has been used on safes and vaults in such a way as to give an alarm when the burglar turns his light upon it. One of its most interesting applications is in the phonopticon, a device for making light waves produce sound (*see* Light). Chemical symbol, *Se;* atomic weight, 79.2.

Sensitive plants. All plants are more or less sensitive, that is, able to respond to stimuli. Some plants, however, respond so quickly and so evidently that they have been popularly called sensitive plants. Conspicuous among them are species of mimosa, acacia, and their allies, members of the pea family. These plants have large compound leaves composed of numerous and very small leaflets. At a sudden touch the paired leaflets fold together, or the whole leaf may fold up and its petiole droop. In the natural surroundings of these plants this folding of the leaves has to do with the avoidance of too intense light or drought, the surface of exposure thus being diminished in exact proportion to the need. (*See* Compass Plants; Plant Life.)

MAN'S *Most* USEFUL TOOL *of* SPEECH—*the* SENTENCE

What We Mean by "Subject" and "Predicate," "Phrases" and "Clauses"—The Various Kinds of Sentences and Some Common Mistakes in Their Use

Sentence. A sentence is a group of words expressing a complete thought, and it is one of man's most common and useful tools. We use sentences almost every hour of every day. But a speaker or writer who makes a sentence must have something to think about, and he must single out some fact concerning it which interests him especially, and assert that fact or ask a question about it. For example, suppose he is thinking about water. If he is going in bathing he is especially interested in its temperature, so he asserts, perhaps, "The water is cold." If he doesn't know whether it is cold or not, he might put his thought in the form of a question: "Is the water cold?" Under other circumstances he might think of the color, and exclaim: "How blue the water is today!"

Now, the part of the sentence that represents what is talked about is called the *subject.* All the rest of the sentence, which asserts or *predicates* something, is called the *predicate.* In all the sentences above, the words *the water* are the subject; the predicate is all the rest of each sentence.

The complete subject of the sentence always contains a noun or a pronoun, or a group of words used like a noun, which stands for the thing talked about. This is called the *subject substantive.* It may or may not have adjuncts or modifiers. In the sentence "People who live in glass houses mustn't throw stones," the word *people* is the subject substantive. It has as a modifier the clause *who live in glass houses,* showing which people are meant. The *complete* subject is the words "*people who live in glass houses.*"

That Much-Needed Verb

The predicate of a sentence must always contain a verb (*see* Verb). Sometimes this verb by itself says all we want to say about the subject; as "The water *boils.*" But often we want to add to the meaning of the verb, to make it clearer and more definite; as "Water *boils more rapidly if you make the fire hotter.*" And again, certain verbs require other words to complete their meaning. Linking verbs, such as *be, become,* take a *predicate* noun, pronoun, or adjective to complete their meaning. Transitive verbs, that is, those that express an action as affecting someone or something other than the subject, must have an *object.* This object may be one word or a group of words; as, "The water burned *me*"; "He said *that the water was cold.*"

Any or all of these necessary or essential elements of the sentence may be made more clear and interesting by the use of modifiers or adjuncts added to them; as, "The water *in the large kettle* is *not* boiling *yet, though the fire is hot*"; "The water *in our pond* is *still too cold for comfortable bathing.*"

These modifiers are either single words, phrases, or clauses. A *phrase* is a group of words not consisting of a subject and predicate, and used like an adjective, an adverb, or a noun; as, *under the tree, finding gold at the rainbow's end, to stay here.* A *clause* is a group of words consisting of a subject and predicate, combined with another such group to make a single sentence. For example, "I came, I saw, I conquered" is a sentence consisting of three clauses, each of which might stand by itself as a single complete sentence.

The Part the Clauses Play

Clauses which are of principal and equal importance in the sentence are called *coördinate* clauses. Clauses which are dependent on some other member of the sentence are called *subordinate.* Subordinate clauses may be used like adverbs, to define the meaning of the principal verb ("I shall come *when I am ready*"); like adjectives, to define the meaning of a noun or pronoun ("This is the house *that Jack built*"); or like nouns ("He told me *what I wanted to know*").

According to form, sentences are *simple, compound,* or *complex.* A *simple* sentence is a sentence that consists of one proposition. Either its subject or its predicate or both may be compound, as: "*Bread* (and) *potatoes* are starchy foods"; People *need certain food elements* (and) *usually enjoy the proper combinations of these*"; *Both men* (*and*) *animals require abundant fresh air* (and) *weaken in confinement.*"

A compound sentence is a sentence that consists of two or more independent propositions or clauses, as: "I came, I saw, I conquered." Propositions should not be joined in a compound sentence unless they are closely related in thought. "John is captain of our baseball team, and the North Pole has been discovered," though from one point of view correct grammatically, is not a real sentence, since it is not the expression of a single thought. The members or parts composing a compound sentence are usually joined by a coördinating word called a conjunction (*see* Conjunction).

A *complex* sentence is a sentence consisting of a main proposition or clause and one or more subordinate clauses; as, "Wait *till he comes.*" "Between the dark and the daylight, *when the night is beginning to lower,* comes a pause in the day's occupations, *which is known as the children's hour.*"

Now in nearly all the sentences we have talked about so far, the predicate states or *declares* something about the subject. For that reason we call such sentences *declarative* sentences. But there are also three other kinds of sentences, distinguished according to meaning. There is the kind that asks a question; as, "Is Buenos Aires the largest city of South America?" These question-asking sentences are called *interrogative* and always end with a question mark (?). Another kind of sentence commands someone to do something; as "Everybody come in!" We call this sort of sentence *imperative,* and often put an exclamation point (!) after it. Then there is a fourth kind of sentence that we use when we want to express strong feeling about something. For example, if you are surprised to wake up in the morning and see a heavy fall of snow you exclaim, "What a lot of snow has fallen!" Such a sentence is called *exclamatory,* and always has an exclamation point after it.

Some very common mistakes in writing are due to vague notions about the difference between a sentence and a clause or phrase. Two or more separate sentences are often incorrectly written as if they were one sentence; as, "The trees by the pond are bare now, they are maples and willows." And, on the other hand, uneducated persons will sometimes treat a part of a sentence as if it were a sentence by itself; as, "He was well satisfied with the returns in health and good fellowship. Though he lost money by the undertaking."

SEPTEMBER. The name of this month comes from the Latin word meaning seven, and it was the seventh month of the Roman calendar (beginning with March). September is the ninth month according to our reckoning. It has always had 30 days. It is preëminently the harvest month, and in it occurs the autumnal equinox (*see* Equinox and Solstice).

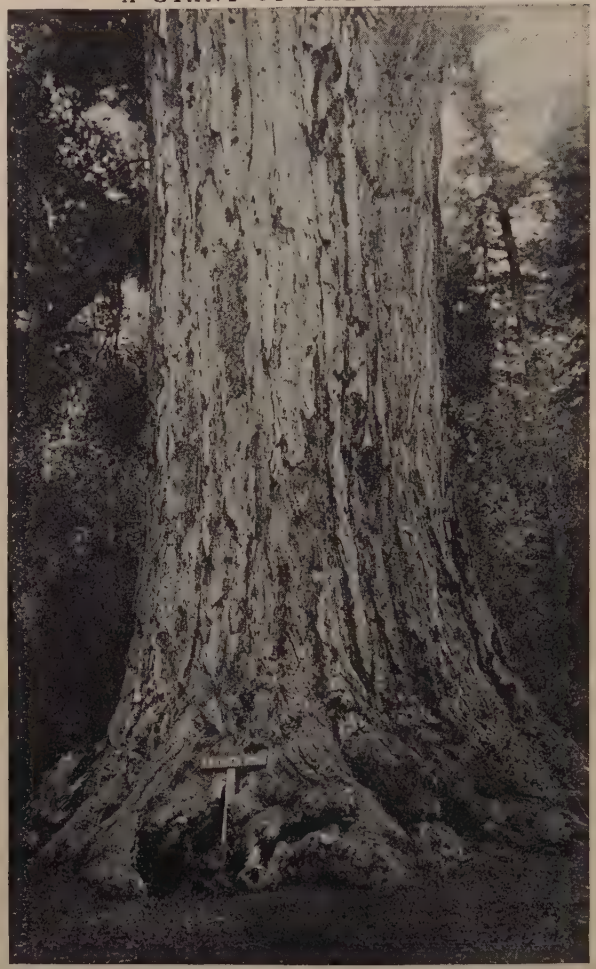
SEQUOI'A. No work of nature is more majestic or more awe-inspiring in its way than the gigantic evergreen sequoia trees of California, the largest and perhaps the oldest of all forest trees. They are of two species, the "big trees," or Washington sequoia, found only on the western slopes of the Sierra Nevada range, whose massive grandeur brings to them thousands of visitors each year, and the redwoods of the Coast Range, which furnish one of the most valuable timbers of the Pacific coast.

Groves of the "big trees," the last survivors of a very ancient and very wonderful family, are carefully preserved in state and national parks. One author says of them: "In stature they are imposing as no other living thing; in age they are a measure for the centuries; in situation they are stranded on the flanks of a mountain range where they are able neither to retreat nor to advance; and in number they are comparatively few." These remarkable giants grow from 200 to 400 feet high, with an average diameter at the ground of 20 feet. They have a bright cinnamon-colored fluted trunk, which often rises branchless to a height of 180 feet. The crown is narrow and dome-shaped, clothed in long sharp-pointed evergreen foliage, from which hang small scaly reddish-brown cones. The tops of the very old trees are much broken from the weight of snow and windstorms. From the annual rings in the wood the age of the largest trees yet felled is known to be from

1,100 to 2,500 years. Many writers believe that some of the still surviving giants are from 5,000 to 8,000 years old.

One of the most famous big trees is the Grizzly Giant, one of the trees in Mariposa Grove, adjoining the Yosemite Valley. At the ground it is 93 feet in circumference. Its royal crown has been shattered and its body stripped nearly bare by the centuries of storms through which it has passed. Another mighty tree has a tunnel through its base through which stage-coaches drive. Inside the fallen trunk of another in the Calaveras Grove near Stockton is a passage big enough for a man on horseback. You may get some idea of the enormous amount of timber contained in one of these giants from the fact that a single tree would furnish enough to encase the great steamship *Lusitania*, torpedoed in the World War, or to box up the Masonic Temple in Chicago.

A GIANT OF THE FOREST



This is an old "Sequoia Gigantea," with a diameter of 26 feet. The bark of the tree is spongy and deeply wrinkled, and often as much as two feet thick. The trunk tapers very gradually and usually has no branches within 100 feet of the ground. The Giant Sequoia is native only to California.

The dark red wood of the "big trees" is light and extraordinarily durable, and in the past thousands of them have been lumbered. Since they have come under the protection of the state and nation, however, their commercial use is limited, and it is left largely to the redwood trees, which are much more plentiful, to supply the sequoia family's contribution of timber. This they do royally, and someone has said: "California might have spared her gold mines, but not the resources of the redwood belt."

The redwoods, which thrive only in the fog drenched forests near the coast, are really a younger growth of the "big trees," which they closely resemble. Their chief difference lies in their method of reproducing, for the "big trees" reproduce exclusively from the cones, while the redwoods also send up suckers to form new trees. Their foliage, which has a reddish-brown tinge, lies in flat sprays, and the cones are borne in clusters, usually in the top of the tree. The wood is light, straight-grained, and easily worked, and when properly dried does not shrink or warp. It is very slow to burn, because it is wholly free from resin, and in contact with soil will last for centuries without rotting. Hence it is valuable for house-building, telegraph poles, railway construction, bridges, etc. Many of the bungalows so characteristic of California are built of redwood, and in communities where it is largely used, the fire hazard is far less than in cities where resinous pine or fir prevails. For certain water supply conduits in engineering projects redwood has been found superior to steel, and many new uses are constantly being discovered for it.

Scientific name of the "big tree," *Sequoia gigantea*. Bark red, fibrous, from 1½ to 2 feet thick, broken into longitudinal wrinkles or furrows. Leaves awl-shaped, 1 to 6 inches long. Cones maturing in second autumn, 2 to 3¾ inches long, composed of 35 to 40 scales. Scientific name of redwood, *Sequoia sempervirens*. Height 100 to 340 feet, trunk 2 to 16 feet in diameter. Crown narrow, branches horizontal or sweeping downward.

SERBIA. In the 14th century Serbia was mistress of the greater part of the Balkan peninsula from the Danube to the Gulf of Corinth. A century later she was the vassal of the Turk, and her people were sold as slaves in the markets of Constantinople. In the 19th century she was freed from Turkish rule and grew in economic and political strength; and in the Balkan Wars of 1912–13—the first fought against Turkey and the second against Bulgaria, her former ally—she just about doubled her territory. Her people cherished dreams of restoring the "Greater Serbia" of their golden age; but up to the outbreak of the great World War of 1914–18, Serbia remained a peasant kingdom of small farmers. Though terribly ravaged by Austrians and Bulgars in that conflict, the Serbians held out dauntless to the end. They reaped their reward in the reunion of the whole of the South Slav race in the "Kingdom of the Serbs, Croats, and Slovenes." (*See* Jugo-Slavia.)

Most of the farmers use clumsy wooden carts drawn by oxen or buffaloes. The Serbians, like all mountaineers, are fierce fighters in war, but they are kind and hospitable in peace. The first farmer you meet will offer you a seat in his cart and is glad to share with you the shelter and the simple table fare of his home, which includes corn cakes three times a day. The mother of the household will bring out her delicious plum marmalade which the Serbians make and export; for plum orchards are to the Serbians what apple orchards are to us.

In the more primitive regions are still found "zadrugas," or community groups of families related to one another, living in separate cottages but having a large building in common in which they eat and spend the evenings.

The little farms of today seldom exceed 20 acres. A Serbian farmer cannot lose all his possessions under a mortgage as an American farmer can because the law will not allow him to give, or another to take, a mortgage covering more than a certain proportion of his land. His cottage he cannot mortgage at all—nor his garden, his plow, or the cattle necessary to draw the plow or haul his products to market.

There are no very rich people, neither are there any very poor ones. There are practically no paupers and there are no poorhouses. The people are not so thrifty nor so industrious as the Bulgars, nor so clever as the Rumanians. Comparatively few are engaged in manufactures, for the Serbian feels that he forfeits his independence by working in a factory. There are some meat-packing plants, flour mills, breweries, iron foundries, potteries, sugar, tobacco, and celluloid factories, and mills for weaving hemp, flax, and wool, but the workers are mainly foreigners. There are a few home industries including spinning, the making of corded sandals such as peasants wear, and handwoven carpets and rugs. They also export native wines, mainly to France and Switzerland. A serious drawback to the commercial development of Serbia before the war was the lack of seaports, which placed the country at the mercy of hostile tariffs. In the new Jugo-Slavia this lack is remedied.

The area of Serbia is about 42,100 square miles, and the population about 5,000,000. Besides Belgrade, the capital, the important cities are Nish, Prisrend, Uskup, and Monastir. The Serbian religion is the Greek Catholic, and the Cyrillic alphabet (similar to the Russian) is used.

The Serbians first settled in their land in the 7th century. The Turkish rule began with the defeat of the Serbians in the great battle of Kossovo in 1389, and was maintained with such cruelty that many Serbs emigrated to southern Hungary. After more than four centuries of tyranny, a group of Serbian patriots organized a rebellion and elected George Petrovitch (called Kara-George or Black George) as their leader (1804). They recovered the district about Belgrade, but were soon forced to flee from the Turkish forces sent against them. In 1815 a second rebellion was organized by Milosh Obrenovitch, who succeeded in establishing the autonomy of the Belgrade government (1829) and proclaimed himself hereditary prince. When Kara-George returned to Serbia he was assassinated by Milosh's orders. The next half-century was spent in feuds between the rival houses of Kara-Georgevitch and Obrenovitch, and attempts to free more Serbian territory from the Turks. The long struggle ended in 1878, when, following the Russo-Turkish War, complete independence was conferred upon Serbia by the Congress of Berlin. In 1921 King Alexander III succeeded his father Peter I, of the Kara-Georgevitch family, who had come to the throne in 1903 following the political assassination of King Alexander I and Queen Draga of the rival dynasty.

Unfortunately Serbia blocked the "corridor" by which Austria-Hungary hoped to reach the Aegean and dominate the Balkans. The result was the series of events which led to the Austrian ultimatum of July 23, 1914, and the World War. (*See* World War of 1914–18.)

The "SEVEN WONDERS" *of* ANTIQUITY *and of* TODAY

Man's Triumphs as a Builder—The Pyramids, Sole Survivors of the Mighty Seven—Babylon's Hanging Gardens, Olympian Zeus, Diana's Temple at Ephesus, the Mausoleum, the Rhodes Colossus, and the Pharos Light

SEVEN WONDERS OF THE WORLD. Of the marvelous works built in ancient times the sightseers of the time of Alexander the Great selected seven as the most wonderful. These were variously listed, but a list found in a little treatise of about the 6th century A.D. gives the following: (1) the Pyramids of Egypt; (2) the Hanging Gardens of Babylon; (3) the Statue of Zeus at Olympia; (4) the Temple of Diana at Ephesus; (5) the Mausoleum at Halicarnassus; (6) the Colossus at Rhodes; (7) the Pharos (lighthouse) at Alexandria. The world has learned much about engineering and architecture, but we still marvel at the massive Pyramids, which stand as solid as ever after the wear and tear of centuries (*see* Pyramids). Except for fragments of the Mausoleum and the Temple of Diana, they are the only "wonder of the world" that remains today.

The Hanging Gardens of Babylon have long since disappeared. They were said to have been built by King Nebuchadnezzar (about 660 B.C.) to please his favorite wife, who had come from a hilly land and wearied of the flat plains of Babylon. Great terraces of masonry, from 75 to 300 feet in height, were built one on top of the other, and on these were planted

gardens of gorgeous tropical flowers and groves and avenues of palm trees, irrigated by water pumped from the Euphrates River. On these "roof gardens" Nebuchadnezzar and his queen could sit in the cool shade and look down upon the beauties of the city.

The Statue of Olympian Zeus was erected at Olympia, in the Peloponnesus of Greece, by the great sculptor Phidias, in the 5th century B.C. It was a towering structure of ivory and gold, 60 feet high, no less remarkable for its majesty and beauty than for its richness and size. It has utterly perished, and our only idea of it is gained from coins of Elis which are said to bear copies of the great original. (*See* Phidias; Zeus.)

Recent excavations on the site of the ancient Greek city of Ephesus, in Asia Minor, have revealed fragments of the pavements, columns, and sculptures of the magnificent Temple of Diana. Their workmanship is so superb that it is easy to see why the ancients regarded the temple as one of the wonders of the world. The first Greek settlers at Ephesus found the Asiatic inhabitants worshiping a many-breasted nature goddess, whom they identified with their own Artemis (called Diana by the Romans). They raised a shrine to her, which was rebuilt and enlarged from time to time. The fourth temple is the one regarded as the "Wonder." It is said to have been built by contributions from all the great cities of Asia and to have taken 120 years to complete, being dedicated about 430 B.C. This great structure, alas! was set on fire in 356 B.C.—on the very night when Alexander the Great was born, it is said—by one Herostratus, who committed this crime merely that his name might be remembered in after ages!

A new temple of Artemis was completed before the end of the century, and it stood until 262 A.D., when it was sacked and burned by the Goths. The great sculptured drums of the lower part of its 60-foot columns, now in the British Museum, indicate that the fifth temple was inferior in workmanship to the fourth. Both were embellished with priceless statues and paintings. They were among the largest Greek temples ever built, the fourth measuring 425 feet by 220—which is larger than the famous St. Peter's Church at Rome (613 feet by 87). The fifth temple was still larger. After the edict of Theodosius (381 A.D.) which closed the pagan temples, the ruins of these ancient structures were used as materials for the construction of Christian churches. Two of the pillars in the great cathedral of Pisa, and the green jasper columns supporting the dome of St. Sophia's in Constantinople, are said to have been taken from the Temple of Diana.

Famous Tomb of King Mausolus

The Mausoleum at Halicarnassus—also in Asia Minor—derived its name from King Mausolus of Caria, who died about the middle of the 3d century B.C. His wife, who was devoted to his memory, employed Greek architects and sculptors to construct and decorate, at Halicarnassus, this superb monument over his remains. It was a great rectangular pile of masonry, surmounted by an Ionic colonnade which supported a roof-like pyramid. At the apex of this pyramid stood a magnificent four-horse chariot, in which were statues of the king and queen. So famous did it become that the word "mausoleum" is now applied to any monumental tomb. Some of the remains of the original Mausoleum are now preserved in the British Museum.

The Colossus of Rhodes was a huge statue of the sun god Helios (or of Apollo), erected in 280 B.C. at the entrance of the harbor of Rhodes, an island in the Aegean Sea near the southwestern coast of Asia Minor. It was built of bronze and was more than 100 feet high. According to the usual belief it stood astride the entrance and it is often so represented in pictures; but as a matter of fact it probably stood at one side of the entrance. It was overthrown by an earthquake in 224 B.C., and after almost a thousand years, the remains were sold for old metal.

The Pharos of Alexandria, in Egypt, was the forerunner of modern lighthouses. The name belonged originally to an island lying off the coast. When Alexander the Great laid out this city to which he gave his name, he connected the island of Pharos with the mainland by means of a "mole" or causeway. On the eastern point of the island Ptolemy I and Ptolemy II, Greek kings of Egypt who followed him, erected a great lighthouse of white marble, said to have been 400 feet high; and it was this structure which came to be known as "the Pharos of Alexandria."

But What were Those Days to Ours?

Amazing as were these wonders of the ancient world, they pale before the wonders of modern times. The Pyramids, mighty as they are, are equaled by such structures as the locks of the Panama Canal and the great dam at Assouan, which England built to store the waters of the Nile. The Hanging Gardens of Babylon, the Mausoleum, the Ephesian temple, and the Pharos sink into insignificance before the skyscrapers and public buildings of to-day.

But the real "wonders" of today are the amazing and beneficent triumphs of modern scientists over Nature, — their discoveries and inventions which enable man to fly like the birds, to talk thousands of miles without wires, to baffle disease, and perform every day and every hour feats which exceed the wildest imaginings of the ancients. So we may list as the "Seven Wonders" of the modern world its seven greatest scientific achievements. Some time ago an American magazine took a vote of its readers as to what these seven modern wonders are. Here is the list that was chosen: (1) Wireless Telegraphy, (2) the Telephone, (3) the Airplane, (4) Radium, (5) Anesthetics and Antitoxins, (6) Spectrum Analysis, and (7) X-rays. If you will turn to the articles which deal with these subjects, and let your mind dwell on the marvels in each of these achievements, you will see that these modern "wonders" are no less wonderful than those of the ancient days.

For any subject not found in its alphabetical place see information

THE SEVEN WONDERS OF THE ANCIENT WORLD

1. First of them all, because they have survived to our own day, are the Pyramids of Egypt. 2. The Hanging Gardens of Babylon were built by Nebuchadnezzar to gratify one of his wives. 3. The Temple of Diana at Ephesus, larger than St. Peter's in Rome, was one of the largest temples ever built. 4. The Statue of Jupiter on Olympus was the master work of the sculptor Phidias; the figure of the god was carved from ivory, and the drapery was solid gold. 5. The tomb of King Mausolus at Halicarnassus in Asia Minor was so superb that the name "mausoleum" has ever since been given to monumental tombs. 6. The Colossus of Rhodes, 100 feet high, guarded the entrance to the harbor of Rhodes. 7. The Pharos of Alexandria was a lighthouse 400 feet high, on whose summit burned night and day a beacon fire.

contained in the Easy Reference Fact-Index at the end of this work

SEVEN YEARS' WAR (1756–1763). When Frederick the Great of Prussia, in 1740, seized the Austrian province of Silesia, he, like the youth who murdered the Austrian archduke at Serajevo in 1914, set off a powder mine that had been laid by the world-wide rivalries of European powers and alliances. The struggle spread from Austria and Prussia to all Europe, and finally burst over the whole world from the Indian rajahs of Hindustan to the European colonists of Canada and New England. For more than a score of years the quarrel disturbed the peace of Europe. In the War of the Austrian Succession (1741–1748)—called by Germans the first two "Silesian" wars—Maria Theresa, the courageous young ruler of Austria, made two vain attempts to recover her stolen lands (*see* Maria Theresa). There was next a breathing spell of eight years. Then in 1756, having won new support among the powers of Europe, she decided to try a third time; but before she and her allies could strike a blow, Frederick the Great, learning of their intentions, invaded the neutral but unfriendly land of Saxony, and so himself began the third Silesian or Seven Years' War.

Since the beginning of the quarrel over Silesia there had been a general shift in the relations of the nations of Europe. In the War of the Austrian Succession Great Britain had taken up arms on the side of Austria, while France had fought alongside Prussia. But when the conflict began in 1756 a "diplomatic revolution" had brought a reversal of alliances. With Prussia was now allied her old enemy, England; for William Pitt, who was now in control in England, saw more clearly than did the stupid George II, with his Hanoverian prejudices, that the second "hundred years' war" between France and England for colonies must be won in Europe. Kaunitz, a young minister of Maria Theresa, also looked at old questions with new eyes. He persuaded her to forget the old French (Bourbon) and Austrian (Hapsburg) rivalry extending over 250 years, and to seek aid in France against her real enemy, the rising power of Prussia. France—or rather Madame Pompadour, Louis XV's favorite—listened, hesitated, and then joined Austria.

The League of the Three Petticoats

On the one side there was Austria, Russia, and France—"the League of Three Petticoats" (Madame Pompadour, Maria Theresa, and Empress Elizabeth of Russia), as it was sneeringly called. On the other was Great Britain with its navy and Prussia with its well prepared army, plus Pitt's statesmanship and Frederick's military genius.

At the outbreak of the war Frederick made himself master of Saxony by the defeat of the Austrians, temporarily invaded Bohemia, and again inflicted defeat upon the Austrians (at Prague, May 1757). Later in the year he defeated the French and his German enemies in the most famous, perhaps, of his battles—at Rossbach. A month later (December 1757) he routed the Austrians at Leuthen. Through the varying fortunes of the two succeeding years, Frederick's military genius enabled him, despite desperate situations when he was ringed about by hostile Russian, French, Swedish, and Austrian armies on Prussian soil, with Berlin occupied and plundered, to wrest victories from his enemies and hold the balance even in Europe, while Pitt directed the forces of England to triumph in America and India. Then George III came to the English throne, in 1760. The genius of Pitt made him uncomfortable. The great minister was forced to resign in 1761, and shortly afterward the money subsidies which England had been paying to Frederick ceased. Frederick's straits were somewhat relieved in the following year, when Elizabeth of Russia died and Peter III, her successor, in his few months' reign made peace with Prussia. Sweden and France fell away from the alliance, and finally Austria, too weak to carry on the war alone, made peace with Prussia at Hubertsburg (Feb. 15, 1763). The map of Europe was not changed by this peace, for Silesia was confirmed as a possession of Frederick.

A War on Three Continents

The war, as has been said, was not confined to Europe. In America the conflict had begun the year before it broke out in Europe, and was known as the French and Indian War (*see* French and Indian War). Here the struggle went against France, and in the end she lost all of her American possessions.

In India English prowess met with like good fortune. The East India Company had founded settlements for trade, which gave promise of extending to an empire; but France, jealous of her hereditary rival, endeavored to snatch the prize. Dupleix, the able French governor of Pondicherry, captured Madras, and by intriguing with the native princes attempted to make French power supreme over the country. In this ambitious scheme he was checkmated by the stupidity of the corrupt French court, which sent him no support, and by the genius of Robert Clive, who from a clerkship in the East India Company rose to be one of the greatest of English generals and the founder of British rule in India (*see* Clive, Robert). The prolonged and desperate struggle in America and in India ended by the Peace of Paris, a few days before the treaty which closed the conflict in Europe (Feb. 10, 1763). France ceded to Great Britain the whole of Canada, together with various islands in the West Indies. The captured French trading stations in India were restored but were not to be fortified. Spain, which had been drawn into the war on the side of France, ceded Florida to England (which held it until 1783), while France compensated Spain with the cession of the Louisiana country west of the Mississippi.

It is not too much to say that the Seven Years' War was a turning point in the world's history. Prussia emerged triumphant and stamped with the military prestige and doubtful diplomacy of Frederick. The Prussian-Austrian struggle for leadership

in Germany was now fairly begun. France, shorn of her colonies and with diminished prestige in Europe, was headed for revolution unless vigorous reforms saved her. Great Britain had acquired a world empire on which the sun never set. The colonies in America had a new conception of their own power and place in the British Empire, and George III was blindly confident that the glories of England's triumph gave the king new power and prestige. The future clash between colonists and the mother country was inevitable.

Sevier (*sēv-ēr'*), John (1745–1815). When in 1780 a band of about a thousand American frontiersmen charged again and again up King's Mountain, N.C., and finally defeated the British, their right wing was led by John Sevier, a frontiersman and Indian fighter of eastern Tennessee. Of the many courageous men who aided in winning the region beyond the Appalachian Mountains, Sevier is by far the most dashing figure. He was not, like most of these men, a crude uneducated frontiersman, but was an educated "gentleman," who traced his ancestry back several generations to a French Huguenot family named Xavier. He was born in Virginia, married at the age of 17, and at the age of 19 founded the settlement of New Market in the Shenandoah valley, where he became a celebrated Indian fighter. In 1772 he removed beyond the Alleghenies to the Watauga settlements, in land claimed by the colony of North Carolina. His learning and bravery made him the natural leader of the people of that district, and they turned to him in all emergencies. They learned anew his fighting ability when he served as captain in 1774 in "Lord Dunmore's War," the name given to the expedition which that governor of Virginia led against the Indians on the Ohio; and again when, during the Revolution, he was one of "Marion's men," and was made a brigadier general.

So, when the people of western North Carolina (Tennessee) revolted in 1785 and formed a separate state, which they named "Frankland" or "Franklin," they elected Sevier its first and only governor. After a three years' struggle with the state of North Carolina, "Franklin" ceased to exist. Sevier for a time was imprisoned by the North Carolina authorities, but escaped. He was then allowed to take his seat as a member of the North Carolina senate, and in 1790 was sent to Congress. When Tennessee was finally made a separate state, he served as its first governor, 1796–1801, and again in 1803–09. At the time of his death he was a member of Congress, having been sent there again in 1811, and was engaged in negotiations with the Creek Indians of the south.

Sévigné (*sā-vēn-yā'*), Madame de (1626–1696). Here was a beautiful, brilliant, warm-hearted woman whose remarkable correspondence with an absent daughter has made people call her "the queen of letter-writers." She was born in Paris, and her maiden name was Marie de Rabutin-Chantal. She grew up to be a lovely, fair-haired, bright-eyed girl, with a velvety skin and graceful ways. At 18 she married a spendthrift marquis, who managed to be killed in a duel, leaving her with a son and a daughter. All the fashionable circle in which she moved admired her beauty, her delightful conversation, and her kind generous heart. It was almost too kind and generous, and poured out far too ardent an affection upon her little boy and girl, who, it must be admitted, grew up into selfish, weak, snobbish creatures, although the daughter did inherit her golden-haired mother's fair face.

When this girl married the Count of Grignan, lieutenant-general of Provence, in the distant south, and thus had to spend most of her time away from Paris, Madame de Sévigné was heartbroken. But it was to this circumstance that we owe the wonderful letters which she wrote to this spoiled petulant daughter, during 25 years. The letters are filled with many little chatty gossipy things, which tell us more than a solemn history ever could about the real life of those days. But what people like most about these letters is their deep affection, bright humor, sincerity, and freshness. For Madame de Sévigné seems to have taken her own delightful, observant, laughing, living self, and put it upon paper for all time.

Seville (*sē-vĭl'*), Spain. It is said that there is never a day when the sun does not shine in Seville, "the pearl of Andalusia," the most Spanish of cities, whose palms and gardens are always green along the brown course of the Guadalquivir. Roses bloom the year round, and olive trees, oranges, and vines flourish.

But Seville is at the height of its glory in April, when the orange trees burst into bloom almost overnight and fill the city with fragrance. "The air is very soft, as of April in Seville" was Columbus' expression of delight as he approached the West Indies in 1492; and it is still the ideal of every Spaniard who can to get to Seville for the great religious processions of Holy Week and the gay spring festival coming at the middle of April.

One of the oldest Spanish cities, Seville still has many traces of the days when it flourished under the Moors, 700 years and more ago. Though there are many fine broad modern boulevards, in the older quarters the streets are crooked and sometimes so narrow that a donkey's swinging baskets of fruits and vegetables touch the house walls on either side. The whitewashed houses have balconies that overhang the street, and through the open gateways one catches glimpses of *patios* or central courts after the oriental fashion, with fountains and orange trees and trellises of flowers. In such ancient streets, life goes gaily on as in the days of old, to the strumming of guitars and the clicking of castanets. Four of the best known operas have sought to catch the color and gayety of street life in Seville: Mozart's 'Marriage of Figaro' and 'Don Juan', Bizet's 'Carmen', and Rossini's 'Barber of Seville'.

Moorish too is the famous Alcazar, which in spite of much rebuilding remains an example of the Moorish fortress palace comparable only to the Alhambra at Granada—a place of gardens and lofty arabesqued halls and courts. Seville possesses magnificent architecture of the Christian type as well, notably its cathedral, which is one of the largest Gothic temples in existence—380 feet long by 250 wide, with the tower-like pillars of its dimly lighted nave soaring to a height of 132 feet. Begun in 1402, it was over a hundred years in building. From the earlier Moorish mosque it retains its beautiful court of oranges, and the Giralda, once a minaret, now a belfry. This delicately wrought tower is so strong that it has withstood earthquakes which all but ruined the mighty cathedral itself. In the cathedral, in the museum, the hospital, and elsewhere one is surrounded by works of the painter Murillo, who, like Velasquez, was born in Seville.

From its wharves among the trees, ocean vessels carry abroad Seville's wines, olives, oils, oranges, and ores. For Seville, although nearly 60 miles from the sea, is Spain's fourth largest city and has been an important seaport from the earliest times, since the Guadalquivir is a tidal stream even above Seville, and admits ships of considerable draught. For many years Seville had a monopoly of the American trade, thereby becoming the richest port of Spain. The city still preserves in its archives documents relating to the discovery and conquest of America; autographs of Pizarro, Cortez, Magellan, and Americus Vespucius; and a signed letter of Cervantes applying for a position in America. In a library founded in the early 16th century by a son of Columbus, Fernando Colon, there is an important manuscript record of Columbus' voyage; and the ashes of Columbus himself now rest in the cathedral, to which they were brought from Havana at the end of the Spanish-American War.

Seville was an important center in Roman times. Part of its water supply is still brought by a Roman aqueduct. It passed into the hands of the Vandals and of the Visigoths; and in 712 it was captured by the Moors, remaining a Moslem city until its recapture in 1248 by Ferdinand III of Castile. Since before Roman times, Triana, a suburb on the right bank of the Guadalquivir, has made pottery. Other important industries are the manufacture of tobacco, chocolate, soap, corks, iron, and silk. Seville has a famous university. Population, about 165,000.

SEWARD (*sū'ĕrd*), WILLIAM HENRY (1801–1872). In the spring of 1860 William Henry Seward, then the recognized leader of the Republicans, left his seat in the United States Senate and retired to his home at Auburn, N. Y., to await the expected news of his nomination for the presidency by the national Republican convention in session at Chicago. To his surprise and chagrin the nomination was given to Lincoln, an Illinois lawyer, whose name was scarcely known outside of his own state.

Seward's surprise was natural, for he had been a brilliant lawyer and a leading figure in New York and national politics for 30 years. He was graduated from Union college at the age of 19, and admitted to the bar two years later. He played politics as easily as he breathed, and he had a ready gift of flowery eloquence. Once, when Lincoln and Seward were on a trip together, and a crowd was calling for a speech, Lincoln turned to Seward, and said, "Seward, you go out and repeat some of your *poetry* to the people."

Seward had served as New York state senator (1830–34), as governor of that commonwealth (1839–43), and for 12 years as United States senator (1849–61). He had long been conspicuous as a foe of slavery, and in 1850 he had created a sensation by a speech in the Senate when he had declared: "The Constitution devotes the Domain (i.e., the territories) to liberty. But there is a *higher law* than the Constitution which devotes it to the same noble purpose." Like Lincoln he had later seen that there was an "irrepressible conflict" between the principles of slavery and freedom, and that the nation must become either all slave territory or all free.

He Accepts Lincoln's Leadership

In consideration of his experience and ability it is no wonder that Seward was deeply disappointed when Lincoln was the one who received the Republican nomination. Nevertheless he hid his chagrin and accepted the position of secretary of state in Lincoln's cabinet. At first he felt, as did most of the country, that he would be the power behind the throne and the president would be a mere figurehead. Soon after Lincoln took office Seward wrote to his wife, "If I am absent only three days, this administration, the Congress, and the District would fall into consternation and despair." In a short time, however, Lincoln had tactfully but unmistakably demonstrated that *he* was the head of the government. Seward's opinion of Lincoln's qualities became so changed that in a later letter to his wife he said: "Executive skill and vigor are rare qualities. The President is the best of us."

During the war Seward had a wide field in which to display his patriotic abilities, and he rendered invaluable service. In spite of the difficulties with England (*see* 'Alabama' Claims; Trent Affair) he managed relations with that country and with France so that neither recognized the independence of the Confederate States, although each had at times seemed inclined to do so.

So prominent a part did Seward play in the administration that on the night that an assassin's bullet struck down Lincoln, an attempt was made on Seward's life also. The wound did not prove fatal, and for four years more Seward carried the heavy burden of the office of the secretary of state, under President Johnson. His greatest achievement after the close of the war was the negotiation of the treaty by which the United States purchased Alaska from Russia, in 1867 (*see* Alaska).

Sewerage. Life insurance experts tell us that the span of life is growing longer. You can expect to live longer than your grandfather, just as the people of his generation lived longer on the average than those of the generation before. This is chiefly the result of our increased knowledge of the causes of disease and improvements in hygiene and sanitation. Among the various factors which help to make life safer and longer today, none perhaps is more important than the science of sanitary engineering, which so greatly reduces disease by safeguarding our water supply and removing poisonous wastes from our houses (*see* Plumbing; Waterworks).

Sewers are built of brick, cement, or stone masonry, and may be 20 feet or more in diameter. Sewage is carried through them generally by natural flow, or gravitation, although sometimes pumping stations are necessary to distribute it properly. The refuse should be mixed with plenty of water to insure a steady flow—at least $2\frac{1}{2}$ feet a second—and in many places rain water and other surface drainage which must be carried away is conducted into the sewers through the catch basins in the gutters. This plan, however, is open to objections, because sometimes sewer gases escape as the storm water enters; and the more sanitary plan is to keep the pipes of the surface drainage system separate from those of the sewer system. In the latter system the flushing of the sewers is done from tanks supplied with water from the city waterworks.

The disposal of sewage, involving some of the most difficult of all engineering problems, has long engaged the attention of city health departments. In small communities each house disposes of its own sewage, usually in the soil, taking care not to contaminate wells or other water supply; but in crowded towns other means must be used.

Sometimes sewage is conveyed out of town to deep water in seas, lakes, or rivers; but even in large bodies of water this often pollutes the drinking water supply, causing typhoid fever and other diseases. It was in order to avoid polluting its water supply from Lake Michigan that Chicago built her $50,000,000 drainage canal (*see* Canals). The more scientific methods of sewage disposal consist of chemical filtration and treatment, so as to kill all organic matter and make the solid matter, or sludge, available as a fertilizer; and the use of bacteria in *contact beds* and *septic tanks* to purify the sewage. Another method is by broad irrigation, or sewage farming—the utilization of sewage in growing crops. The sewage is run over a large area of land and left to oxidize in the air. The Chinese thus make use of material which otherwise would be wasted. The world's largest sewage farms are those of Paris and Berlin.

Such systems of sewage disposal as are in use today date only from about the middle of the 19th century. During the Middle Ages open drains running through the streets served as sewers. In later times the sewage was conducted to open cesspools on the outskirts of the city. The ancient Romans had sewerage systems far in advance of anything known in Europe until the 19th century, draining the city by three natural streams confined within stone tunnels. The largest of these, the *Cloaca Maxima*, parts of which date from the 3d century B.C., is still in use.

NEEDLE ARITHMETIC : ONE EQUALS NINE

The Little Stitch that Saves Nine and How to Take It

How to Patch, Darn, and Make Buttons Stay Put

Sewing. One of the first things a certain little girl remembers is how an aunt of hers, who was teaching her to sew, would look at her over her steel-rimmed spectacles and say, "You know, my dear, a stitch in time saves nine."

"Yes ma'am," she would answer politely, and then wonder and wonder, "Nine *what?*" It wasn't until she was quite a grown-up girl that she knew her aunt meant that one stitch sewed when a tear or hole was tiny would save sewing nine or maybe more stitches if she let the hole go unmended until it grew big.

Suppose we start in today to learn to mend and then, perhaps tomorrow, you can make something really new, right from the beginning.

Mending is the best thing to begin on in learning to sew, for many reasons. First, if the sewing doesn't come out just right you won't be spoiling new material. Second, if you learn to mend, you can mend while mother spends her time on making pretty new dresses for you. Third, each piece of mending doesn't take you as long as it would to make a new garment, and you won't get tired and discouraged about it.

Fourth, you can learn all the sewing stitches in mending. And the last reason is, that if you always keep your clothes well mended you will look much better dressed than girls who have more clothes, but who are careless about loose hooks and eyes and missing buttons and don't mend little tears and rips.

Now get everything ready on a broad window sill or little table where you can have good light and a comfortable chair. Here are the things you will need if you are going to do all kinds of mending.

1. A pair of small sharp scissors.
2. One large, one small, and one darning needle.
3. Darning cotton in the colors of the stockings.
4. A darning egg or hard ball of some sort.
5. Number 40 white and black cotton thread for sewing on buttons.
6. Old muslin for patching.
7. Number 60 white and black thread for sewing on ripped lace.
8. A tape measure.
9. A thimble.
10. A package of pins.

Put your thimble on the third finger of your right hand and push the needle with the top or side of it, and you won't have a sore finger when you are through sewing. You had better leave silk stockings for mother to do until you learn to darn cotton stockings extra well.

Each little girl who takes this sewing lesson will have different kinds of mending to do; so we are going to try to write a sort of handbook of mending, so you can find directions for just the kind you need when you start to mend.

Basting.—Basting is like so many games you play that it ought to be easy for you. It is used to hold two edges of cloth together, or to hold a patch on until you do the finer stitches that will stay in and make the mending strong. Then you pull the basting thread out. Pretend that you are playing jump from one stone or one step to another one. Then you will see how basting should look. Each step or stone is a small stitch and the space you jump is the long stitch in between. As in this picture (Fig. 1), put your needle *down* through the cloth at number 1, then *up* through the cloth at number 2. This will bring the needle through to the right side. Then jump your needle to number 3 and put it down at 3 to the wrong side, and up through 4 to the right side. Now jump to 5 and do the same way with each stitch. Hold the two pieces of cloth firmly together so they won't slip, and be sure at each stitch that your needle goes clear through both pieces of cloth.

Fig. 1. Basting

Buttons.—First find the button which came off the garment or one that nearly matches it in size, color, and material. Of course for a coat or dress you must have one just like the rest. Sometimes when a button of this kind is lost you can take one from another part of the coat or dress where it won't show.

Thread your large needle with No. 40 thread of the right color. Pull the ends of the thread together, so that the thread is double, and tie a knot. Mother can show you about the knot better than it can be explained here by pictures or writing. Mark, with a pin, the place where the button is to go. Start the needle by pushing it from the right to the wrong side. Then the knot will be on the right side and under the button. Bring the needle through to the right side and put it through a hole in the button. Put a pin across the top of the button and hold it with your left hand until you have taken enough stitches to hold it in place (Fig. 2.)

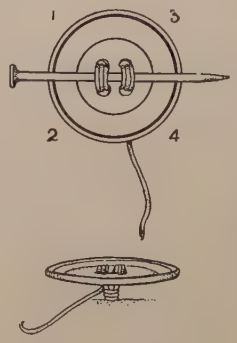


Fig. 2. Sewing on Buttons

The needle should go up through the hole number 1 and down through 2, up through 1 and down through 2 for a button with two holes. For a button with four holes, up at 1, down at 2, up at 3, and down at 4, then up at 1 again, and over and over the same way until the button is sewed tight. Now pull out the pin and pull the button gently until the threads are tight. Push the needle from the wrong side and bring it out *between* the cloth and the button. Hold the button in your left hand and wind the thread tightly around the stitches three or four times. Push the needle to the wrong side and fasten the thread. The pin is used to make the stitches long enough to make the little neck, and the thread is wound around the stitches to make them strong. This neck of thread gives room for the buttonhole to go under the button.

Snap Fasteners.—Mark the place for each part of the snap with a pin. With a strong thread matching the snap in color take a tiny stitch in the cloth where the snap is to be sewed, then, holding the snap over the knot, put your needle in the cloth beside a hole in the snap and take a stitch to bring your needle up through it. Repeat several times, then slide your needle under the snap to the next hole. When all the holes have been sewed through, fasten and cut your thread.

Buttonholes.—Sometimes the buttons have pulled until they have torn through the buttonholing, and then it must be fixed or there will be a bad tear through the edge of the garment. First, catch the torn place together until it is as nearly the size of the old buttonhole as possible, and fasten securely. Then buttonhole over the mended place. To make buttonholes with a nice cord along the edge, bring the needle through and throw the thread over the needle toward your left hand (Fig. 3). When you come to the outer edge of the buttonhole make three or five stitches around it throwing the thread the other way. This is called "blanket-stitching"; it makes a very strong edge, but it does not make a cord as along the sides.

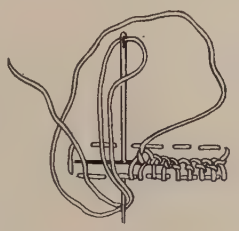


Fig. 3 Making a Buttonhole

Hooks and Eyes.—Always use very strong thread for sewing on hooks and eyes. Mark with pins the place where they are to be sewed so you will be sure to have them exactly opposite each other. Put the loop of the eye a little beyond the folded edge of the cloth. For the straight kind of eye put it about a quarter of an inch in from the edge. Hold the eye in place with your left hand. Sew closely over and over the two circles of the eye, until they are covered with thread; then take three or four stitches over each other at the bottom of the loop on each side. Be sure to fasten your thread well. Lap your two pieces of cloth, and put the hook into the eye which you have sewed on. Hold the hook in place with your left hand and take it out of the eye. Sew over and over the two circles, as you did with the eye, then sew in the same way the under part of the hook clear up to the bend.

Darning.—Darning is done the same way you used to weave paper mats at kindergarten or in the first grade. Be sure to use only two or three threads of the darning cotton. It is usually made of six threads, so you will have to divide it. A heavy thread makes a hard lump and hurts your feet. Pull your darning thread just smooth, but not tight enough to pucker the edges of the hole, for this makes a lump.

Place your darning egg under the hole, but do not pull the stocking tight, only smooth, or you will stretch the hole larger. Thread your needle, but make no knot in the thread. Start at the top of the hole (the edge nearest the top of the stocking) about one-half inch from the edge of the hole (Fig. 4). Take some small running stitches to the edge of the hole, bring the needle to the other side of the hole, and take running stitches here for half an inch. Do another row about one-eighth of an inch from the first one and keep on until you have up and down threads clear across the hole. This looks now like the paper mats before you begin to weave. Start to sew in small running stitches across the first ones until you reach the hole. Go over and under, under and over, these straight threads, exactly as though you were weaving paper mats. Make your rows close enough together so they leave no empty spaces, and fill up the holes. You must always take the running stitches beyond the edge of the hole or the darn will be apt to tear away, as the cloth near the hole is usually thin and not strong. A really good darn should be almost as smooth as the stocking. If it is not, you are using too heavy a thread or pulling it too tight.

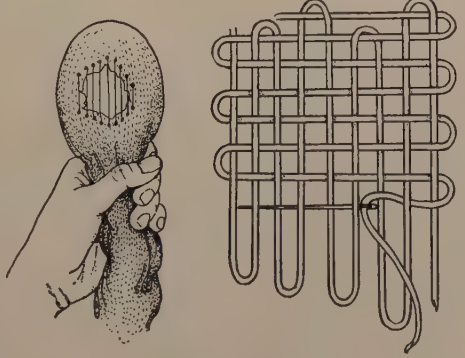


Fig. 4 Darning

Gathering.—Gathering is needed in mending when an apron or skirt has torn from the band. A double thread is best as it is strongest. Fold the goods to mark where you wish to sew, or sew along the old line of sewing. Use a stitch like the basting stitch but make the space between the stitches shorter than in basting. Put a pin at the left hand or finishing end of the gathers. When your gathering thread is in, pull it until the goods is the same length as the piece to which it is to be sewed. Wind the thread around the pin to hold the gathers tight. Push gathers evenly so that they are not in a bunch. Then hold the edge of the skirt and the edge of the inner side of the belt together so that the raw edges will be on the outside, and sew together with a small running stitch. Smooth the upper piece of the belt down over the seam you have just made, fold in the edge a quarter of an inch, and sew to the skirt with a small hemming stitch.

To fasten the thread at the end of the seam, make three or four stitches in the same holes. In fastening basting you keep sewing the last small stitch, going down and up three or four times over the stitch and then cutting your thread.

Hemming.—Be sure that the edge of the cloth to be hemmed is straight. Make a folded edge about one quarter of an inch wide. Crease it hard with your thumbnail. Then fold over again, this time as wide as you want the finished hem to be. If you are making a hem more than half an inch wide, you had better measure every few inches, as you fold, with a piece of stiff cardboard. When you have folded the hem, baste it in place. Tie a knot in your thread; then holding the fold toward you and the loose edge hanging down, put the needle through the fold, at the right-hand end,

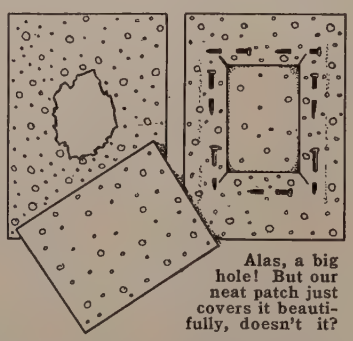
and slip the knot underneath, so it is hidden. Now take two or three threads of the cloth and two or three threads of the fold and pull the needle through. Have your needle pointing in a slanting stitch toward your left shoulder. When you need a new thread, fasten the old one with tiny stitches and hide the knot of the new one under the fold.

Overcasting and Overhanding.—Overcasting and overhanding are almost the same, except that overhanding is done closer together. They are both very easy and with a little practice you can make the stitches even in depth and in distance apart. Overcasting is done to keep the edge of material from raveling. Overhanding is used in sewing on lace or joining two selvages or folds together.

It is best to baste the two pieces of material together if you are not an expert at sewing. Put the needle between the two layers of goods for the first stitch so that the knot will be hidden.

For overcasting make the stitches one-eighth of an inch deep and about a quarter of an inch apart, and hold the needle slanting toward your left shoulder. For overhanding take up only a few threads of the cloth. Make the stitches close together and point the needle straight toward you.

Patching.—Sometimes you will have a hole to mend that is too big to darn and you will have to patch it. First cut all the rough edges and loose threads away. Cut a piece of cloth to match the garment, at least twice as big as the hole. Pin it under the hole so that the pattern, if there is one, matches perfectly. Turn under the edges of the cloth on the right side and baste down. Put the patch on the wrong side, so that it is just big enough to cover all the thin part which is usually around a hole. Fold under the edges of the patch and baste. Now hem, with small stitches, the basted edges on both sides of the goods. Pull out the basting threads and press the patch. If you want a very nice patch, cut the hole square before you start to patch it. Then make a cut about a quarter of an inch deep at each corner so that the edges will turn under nicely.



Alas, a big hole! But our neat patch just covers it beautifully, doesn't it?

Running.—The running stitch is much like basting, except that the stitches and the distance between the stitches are of even length. It is used for quick hemming and for gathering. Start at the right-hand end of the cloth and make the needle go under and over, under and over, the threads in the cloth, taking *up* as many threads as you go *over*. Only please don't try to count the threads, as this would strain your eyes. Just make the stitches as even as you can.

Seams.—The running stitch you have just learned will be very useful to you if you have a ripped seam in your dress. If the seam is an open seam, hold the two edges together on the wrong side of your dress and sew with a short running stitch until the ripped place has been completely closed. Then open out your seam and press flat. If the seam is a French seam, sew up the ripped place with a running stitch so that the raw edges are on the right side of your dress. Open the material, turn the sides over the seam, and again sew up the ripped place with a running stitch so that the first seam is inside the second one. Then no raw edges will show. This makes what is called a French seam.

Making a Bean Bag.—And now the lesson part is over and we can have some fun. Let's make bean bags! Then get brother to cut a few holes in a board, paint a number—5, 10, 15, 20—one below each hole, and get ready for a game of "chuck-a-luck."

We will make bean bags while the board is being made. For each bag cut a piece of cloth four and one half by nine inches. Fold this so it makes a square, and baste two of the sides to hold them firm. The fold makes the third side, and the fourth side we must leave open to put in the beans.

Sew the two basted sides with a small running stitch and then *overcast* the rough edges. Turn the bags right side out. Fold down the open edge a quarter of an inch deep all around so that the fold is on the inside. *Overhand* the two folded edges together for about half the length of the side. Fill the bag half full of beans or peas or small pebbles, and finish sewing up the side. Use strong thread (about No. 40) and fasten it well. These bean bags will be a real test of careful sewing, because they must be well sewed and carefully fastened or they will surely pop open, and the beans will be lost and the game over before you have managed to throw them through the holes in the board.

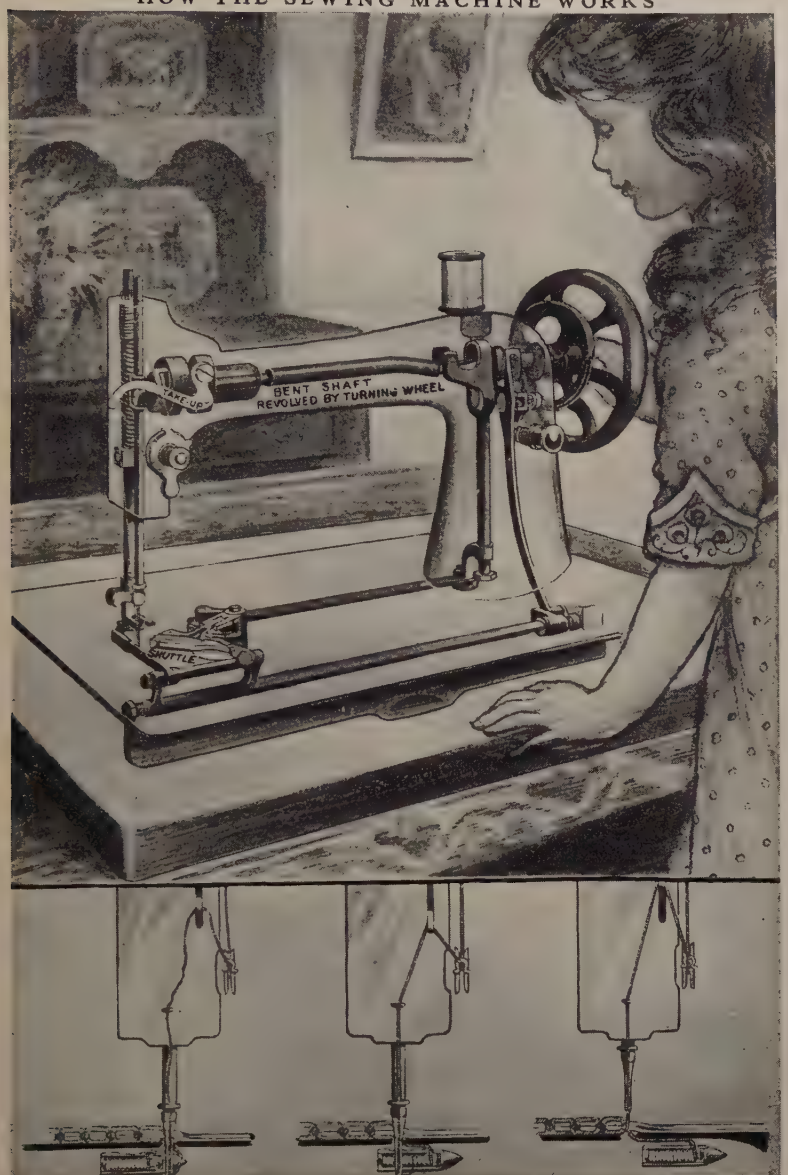
And now we must give you some advice on how to use mother's sewing machine. It is simply this: *Don't*, unless she has time to teach you how to use it the right way. But if you will first learn how to do hand sewing well, mother will no doubt be glad to have you learn to sew on the machine.

SEWING MACHINE. From the middle of the 18th century many inventors in England and the United States tried to make machines that would imitate the movements of the needlewoman's fingers. One of the vital defects in the earlier inventions was that the cloth had to be "fed" to the machine by hand. No substantial progress was made toward building a practicable sewing machine until about the middle of the 19th century.

For any subject not found in its alphabetical place see information

By that time it was realized that it was not necessary for the whole needle to go through the cloth for each stitch; and the machine needle with an eye near the point, and the "lock stitch"—such as are in use today—had appeared. The lock stitch makes use of two threads. The first thread, passing through the eye of the needle, is pushed down with the needle through the cloth, and forms a loop below. The other thread, underneath the cloth, is carried through the loop by a shuttle, thus "locking" the stitch.

HOW THE SEWING MACHINE WORKS



The motion of the bent shaft turned by the wheel is changed by a series of cams into the up-and-down motion of the needle and the to-and-fro motion of the shuttle. The "take-up" makes the thread fed to the needle alternately tight and loose, as needed. The three pictures below show how the upper thread catches up the lower to make a stitch, the shuttle passing through the loop in the upper thread each time the needle comes down.

Such a needle was combined with the lock stitch in a machine patented about 1846 by Elias Howe of Massachusetts. This, the first really practicable sewing machine, was further equipped with a mechanical device for feeding the cloth, but the needle moved back and forth horizontally instead of vertically, as in our modern machines. Howe and his machine were denounced by garment workers and tailors, who feared it would deprive them of their means of livelihood. But gradually his machine came into use; and for about 25 years—the courts having sustained him in 1854 in a long legal fight over patent rights—Howe collected royalties on every machine made, and thus was lifted from poverty to a fortune of more than $2,000,000 (*see* Howe, Elias).

About the same time John Bachelder devised the first machine combining the horizontal table with a continuous feeding device that would sew any length of seam. He used a leather belt set with small steel points to carry the material along. But the greatest improvement of all was made by Allen B. Winslow, a Michigan cabinet maker, who in 1854 patented his celebrated "four motion feed," employed in practically all machines today. This device consists of a toothed metal plate which moves forward, carrying the cloth with it, then drops out of contact with the cloth, moves back, and rises to carry the cloth forward again.

Meanwhile, Isaac M. Singer had invented the first "rigid arm" sewing machine, and had made important improvements in the shuttle. He finally obtained a patent after a long law suit with Howe. James Gibbs invented a "chain stitch" machine, later improved by J. Willcox, also an American. In this machine the loop of each stitch passes through and, by means of a hook, secures the loop of the previous stitch, something like the stitch in crocheting.

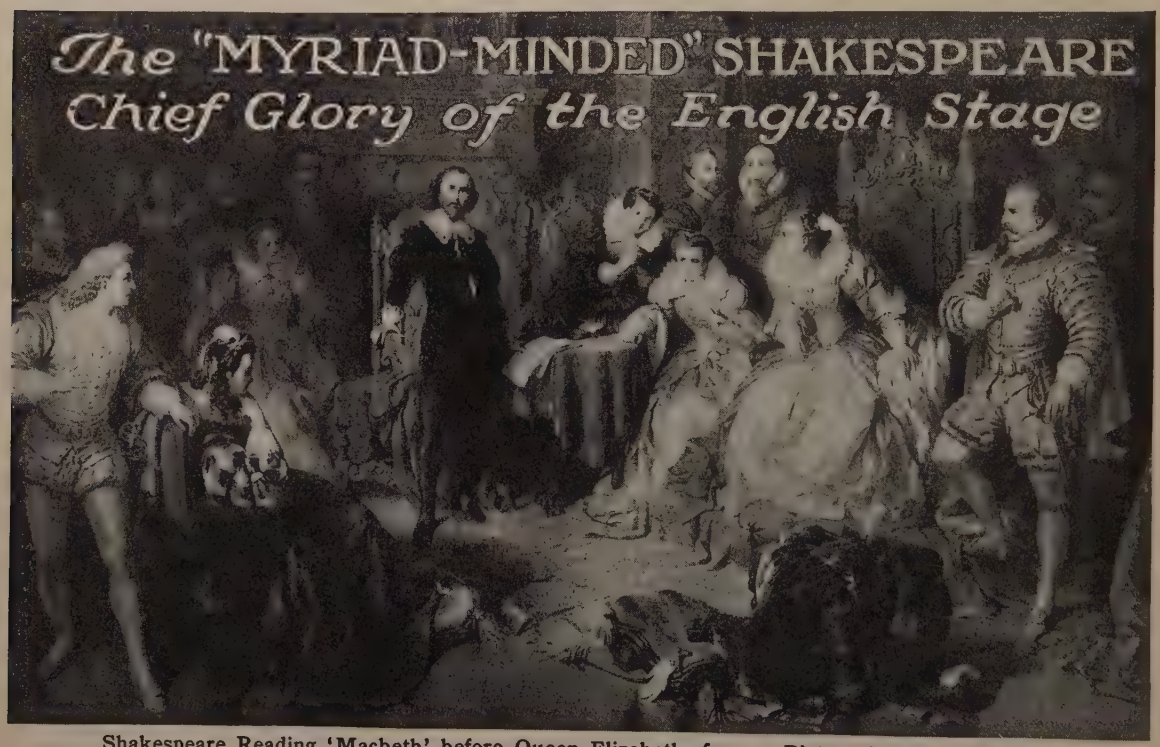
These early machines have been developed to such an amazing extent, both for home and factory uses, that today there are machines for sewing almost every article of clothing, upholstery, embroidery, canvas, leather goods, etc., some of which run as

fast as 4,000 stitches a minute. More than 600 kinds of machines are made by one company. There are machines for making buttonholes, and others for sewing on buttons. There are machines for faggoting, feather-stitching, pattern-stitching, hemstitching, smocking, ruffling, tucking, side and box plaiting, basting, and quilting. There are single and double needle machines, and those with four, six, and eight needles for glove work. Of these special machines the most important is the shoe-sewing machine (*see* Shoes). Meanwhile the household type has been improved and modified, chiefly in order to carry special attachments, until now the same machine can handle a great variety of work.

The United States leads the world in the manufacture of sewing machines and its output goes to the remotest parts of the globe.

Shad. This highly esteemed food fish belongs to the herring family, but is larger than the ordinary herring—averaging three to six pounds—and differs from it in the absence of teeth in the jaws and in the form of the cheek, which is deeper than long. The numerous slender pinlike bones which prove so annoying when one is eating shad are chiefly several series of bones which support the muscle segments above the ribs.

The shad fisheries in Delaware Bay and River, Chesapeake Bay, and North Carolina sounds are very extensive. In the bays and estuaries the fish are taken in pound nets and weirs, but in the rivers gill nets and seines are used, some of which are more than a mile in length and are hauled in by means of donkey engines. There are several species of shad, all of the genus *Clupea*.



Shakespeare Reading 'Macbeth' before Queen Elizabeth, from a Picture by Eduard Ender

Shakespeare, William (1564–1616). Only in the "spacious days" of Queen Elizabeth could Shakespeare's genius have been fostered and developed to the full. The religious strife of the Reformation was at a lull, and by the defeat of the Armada the nation had escaped the danger of Spanish conquest. The dawning New World was opening to English colonization through the labors of Cabot, Drake, and Raleigh. New lands, new ideas, new books, the new learning of the Renaissance, had set the imaginations of men on fire. Altogether, Englishmen found the world with its new horizon a place well worth living in. Men were anxious to learn all there was to learn and to feel all there was to feel, and no other form of art could bring the world to England's door more readily than the drama. Such an age demanded a genius to hold up the mirror to all its rich and varied life, and found him in William Shakespeare.

It is strange that although the people of his time loved and honored Shakespeare as "Soule of the Age" (as his friend Ben Jonson put it), there is a very scanty amount of actual fact left to us on which to base an account of his life. Scholars have gone to

SHAKESPEARE'S BIRTHPLACE, FROM THE GARDEN

The garden at the rear of the old Stratford house (at the right) in which Shakespeare was born is now made fragrant with the flowers and shady with the trees named in his works. The stone in the middle of the broad path is the base of the old 14th century "market cross" which once stood in the Stratford market square.

great pains to unearth obscure documents which touch his life, and to trace the development of his mind and character from his plays and poems; but we still know so little about the external events of his life that some have even questioned whether he was the author of the works that bear his name.

William Shakespeare was born at Stratford on the Avon near the end of April 1564. The exact day is uncertain. His parents came of good country stock that had lived in Warwickshire for generations. His father dealt in agricultural products and was at one time a glover and at another a butcher. The poet's mother, in spite of the fact that she came from a prosperous family, had no education; for women in those days were rarely educated.

William was their third child. He was fortunate in living in Stratford, because the town had the unusual advantage of a free endowed grammar school which all the sons of "freemen"—members of the governing body of the town—were entitled to attend. It is there that Shakespeare learned the "small Latine and lesse Greeke" of which his friend Ben Jonson writes. The French and Italian, with which he must have had some acquaintance, he probably acquired in London.

A genius, however, owes the least of his knowledge to schools. Shakespeare had the type of mind that sees a thing once and remembers it always, reads a thing once and makes it his own. And there were many advantages for him in his little town. Wandering companies of players turned his thoughts early to the stage. The historic pageant given at Kenilworth Castle for Queen Elizabeth by the Earl of Leicester must have aroused the boy's imagination, even if he did not see it himself. Then, too, Warwickshire, in which Stratford lies, is one of the most beautiful parts of England and, wandering through its woods and over its low hills, Shakespeare had ample chance to learn birds, flowers, and streams in all their "various language." His plays show that he loved nature and that he knew the country folklore. Books were few, but he had the Bible in English which could not help affecting his thinking and his style. Shakespeare's work shows plainly that he went through life with open mind, and what did not come to him directly his imagination could supply.

No one has as yet entirely accounted for his leaving Stratford about 1586. Some say that the unhappiness of his married life led to his departure; for at 18 he had married Anne Hathaway, a young woman eight years older than himself. Others say that his father's failure in business laid heavier burdens on the son. Still others cling to the tradition that Shakespeare had got into difficulties by putting mocking verses on Sir Thomas Lucy's gate—a nobleman who, as the story runs, had prosecuted him for deer-poaching in his park. No one knows the real reason for Shakespeare's departure, but it is a generally accepted fact that in his 21st year the young man left Stratford and walked to London by way of Oxford.

Almost nothing is known of his first years in London. It is not until six years later that we find any reference to his life there. In that year Robert Greene, a playwright who was then on his death-bed, published an attack warning his friends to beware of Shakespeare and of others of his kind. "Trust them not," he says, "for there is an upstart crow beautified with our feathers that with his Tyger's heart wrapped in a player's hide supposes he is well able to bumbast out a blank verse as the best of you; and being an absolute *Johannes Factotum* ("Jack of all trades") is in his own conceit the onely Shakescene in a countrie, but it is a pity men of such rare wit should be subject to the pleasures of such rude grooms." Soon after, a friend of Greene's printed an apology for the attack, saying that Shakespeare was "excellent in the quality he professes." By his 28th year, then, it is plain that he was prominent enough in the theater to have aroused both the envy and the admiration of his associates.

WHERE THE POET LEARNED HIS LESSONS

In this delightful old room, with its timbered roof, Shakespeare doubtless learned his "small Latine and lesse Greeke"; for this is the old Grammar School, in which Stratford boys have been taught from generations before Shakespeare's time to the present.

After all, there is a grain of truth in Greene's epithet "Jack of all Trades." On his arrival in London it is believed that he earned his living as call boy or page in a theater, but was soon promoted to small parts on the stage. His name came to be associated on playbills with that of Burbage, Kempe, and Condell, who were the best actors of the day. But Shakespeare never played leading characters. It was in such parts as that of the ghost in 'Hamlet' and of Adam, the old man in 'As you like It', that he appeared at the Old Globe Theater perhaps sometimes before Queen Elizabeth herself.

Shakespeare Finds His Field

Shakespeare soon learned that his bent was not for acting but playwriting—adapting old plays, imitating others, and writing dramas of his own for production in the theaters to whose companies he belonged. He took the blank verse which Greene and Marlowe had used before him and made it the most varied and flexible of English rhythms. He learned how to carry over the meaning from line to line; how to vary the pauses so that what had been a rather monotonous form now became a delicate instrument on which he could play as he wished. His power grew through the years. Each play shows greater freedom than the one which preceded it—not only in verse music but in construction and in the depth and power of the emotion expressed.

The chief plays are treated separately in these volumes under their titles. Here we shall only outline Shakespeare's development as a dramatist. He wrote about two plays a year and with such apparent ease that the players in his company boasted that he never blotted a line. Roughly speaking, there are four periods in his career, which covered about 20 years—from 1591 to 1611. A well-known Shakespearian critic very aptly names these periods: "In the Workshop," "In the World," "Out of the Depths," and "On the Heights."

In the beginning he experimented, for the plays of the early period are of all kinds. He imitated the brutality of Marlowe in 'Titus Andronicus'. In 'Love's Labour Lost' he balanced phrase against phrase after the fashion of Lyly. He dramatized a romance in 'Two Gentlemen of Verona', and probably adapted and transformed many other plays which have been lost. 'Romeo and Juliet', probably written in 1597, is the first play which shows promise of his full powers. The plot was not his own, nor all the characters, but he put into it so much ardor and beauty that what he borrowed he made his own.

The plays of the second period consist largely of histories and comedies. England was eager to see her glorious and eventful story on the stage, so Shakespeare constructed a series of plays from Holinshed's 'Chronicles of England, Scotland, and Ireland' (1578). 'Henry IV' in its two parts is the best of these. All that he wrote at this time was marked by a light-hearted flow of spirits and tingles with the joy of living. To this period belong Falstaff, his greatest comedy figure, and the whole-souled women who delight us with their wit and laughter. Portia, Beatrice, and Viola are among his loveliest characters.

For any subject not found in its alphabetical place see information

About 1600 Shakespeare seems to have passed into a mood of solemn questioning of life and death. His plays are no longer light-hearted, but become somber in tone and deeply philosophic. 'Hamlet' and 'Macbeth' require many readings and much thought to understand them, but they are the plays that we should be most loath to lose. 'King Lear' calls on all the elements of air and sky as a fit setting for the disappointed passion of the old mad king. In 'Othello' the passion of jealousy inspires a tragedy strong in form and masterly in dialogue and description. Terrible as these plays are in theme and plot, they are so permeated by Shakespeare's deep understanding of human nature and real power as a poet that they stand supreme among his works.

The last period of Shakespeare's career began after 1608. In it are found the plays which combine the wisdom of the Hamlet epoch with a more genial outlook on life. 'The Tempest', 'Cymbeline', and 'The Winter's Tale' show the serenity which so often color the more mature years of a great man's life.

THE OLD GLOBE THEATER

In this dingy uncomfortable little theater in Southwark (long since destroyed) many of Shakespeare's plays, as well as those of Beaumont and Fletcher, Ben Jonson, and Ford, were produced. Shakespeare was a shareholder in it and drew from it some of the income on which his later prosperity was based.

Shakespeare's activities as an actor, as part owner of several theatres, as a playwright and poet made him a moderately rich man. He returned to Stratford to live and bought New Place, which is just around the corner from his birthplace. He probably divided his last six years between Stratford and London. He died in 1616, only 52 years old.

It is unfortunate for us that Shakespeare did not oversee the printing of his plays, but in his day such was not the custom. It was thought that it was to the interest of the theater to keep plays in manuscript, so that people must come to the playhouse if they wished to become acquainted with a writer's dramas. The result was that texts of only 16 of Shakespeare's plays were printed before 1623. Some of the 16 were duly registered according to law (copyrighted), and then printed, while others were taken down in shorthand in the theater and printed without permission. The latter copies were very faulty. Various editions of the plays were printed after Shakespeare's death, but it was not until 1623 that a complete edition (the first "folio" edition) was put forth, based in part on 20 hitherto unpublished plays furnished by John Hemings and Henry Condell, actors of Shakespeare's company. The edition was a success and another one was printed nine years later. Since that time hundreds of scholars have spent years in trying to make the copies of the plays as accurate as possible. New editions came out from time to time in English and in translations into all modern languages—for Shakespeare's works are as well known in Germany, France, and Russia as are those of their own great writers.

Besides his plays, Shakespeare composed over 150 sonnets — short rhymed poems of 14 lines each—which remain among the noblest lyrics in the language. He wrote also several longer non-dramatic poems which he dedicated to the Earl of Southampton, his friend and patron.

What is it that makes Shakespeare endure as the supreme dramatist of the world, in spite of his many obvious faults? We may answer that he combines all the qualities that make literature enduring. He combines wisdom to understand and charity to forgive human frailties. He has the power to make humanity real, with feet fast on the ground no matter how high its head may tower toward the clouds. Gaiety, light-heartedness, laughter, pity, tears, passion, are all his. His work has the ease and careless grace of all masterpieces—and above all it is charming to the ear. As Ben Jonson truly said, "He was not of an age, but for all time."

Although there is considerable difference of opinion as to the dates of some of Shakespeare's works, most critics agree in general to this classification:

Period of Early Experiment — ("In the Workshop") (1591-1595). 'Love's Labour Lost'; 'Two Gentlemen of Verona'; 'Comedy of Errors'; 'Henry VI' (three parts); 'Richard III'; 'Richard II'; 'Titus Andronicus'; 'King John'; and the poems 'Venus and Adonis' and 'The Rape of Lucrece'.

Period of Development — ("In the World") (1595-1600). 'Romeo and Juliet'; 'Midsummer Night's Dream'; 'Merchant of Venice'; 'Taming of the Shrew'; 'Henry IV' (two parts); 'Merry Wives of Windsor'; 'Henry V'; 'Julius Caesar'; 'Much Ado about Nothing'; 'As You Like It'; 'Twelfth Night'.

Period of Maturity and Gloom — ("Out of the Depths") (1600-1608). 'Sonnets'; 'Hamlet'; 'Troilus and Cressida'; 'Othello'; 'All's Well that Ends Well'; 'Measure for Measure'; 'Macbeth'; 'King Lear'; 'Antony and Cleopatra'; 'Timon of Athens'.

Period of Serenity — ("On the Heights") (1608-1611). 'Pericles'; 'Coriolanus'; 'Cymbeline'; 'The Winter's Tale'; 'The Tempest'; 'Henry VIII'.

contained in the Easy Reference Fact-Index at the end of this work

THE BEAUTIES OF NATURE

Night's candles are burned out, and jocund day
Stands tiptoe on the misty mountain tops.
—*Romeo and Juliet, Act III, Scene* v.

But, look, the morn, in russet mantle clad,
Walks o'er the dew of yon high eastern hill.
—*Hamlet, Act I, Scene* i.

How sweet the moonlight sleeps upon this bank!
Here will we sit and let the sounds of music
Creep in our ears. Soft stillness and the night
Become the touches of sweet harmony.
Sit, Jessica. Look how the floor of heaven
Is thick inlaid with patines of bright gold.
There's not the smallest orb which thou behold'st
But in his motion like an angel sings,
Still quiring to the young-ey'd cherubims;
Such harmony is in immortal souls;
But whilst this muddy vesture of decay
Doth grossly close it in, we cannot hear it.
—*The Merchant of Venice, Act V, Scene* i.

THE POWER OF MUSIC

The man that hath no music in himself,
Nor is not moved with concord of sweet sounds,
Is fit for treasons, stratagems, and spoils.
The motions of his spirit are dull as night
And his affections dark as Erebus.
Let no such man be trusted.
—*The Merchant of Venice, Act V, Scene* i.

If music be the food of love, play on!
Give me excess of it, that, surfeiting,
The appetite may sicken, and so die.
That strain again! It had a dying fall.
O, it came o'er my ear like the sweet sound
That breathes upon a bank of violets,
Stealing and giving odour.
—*Twelfth Night, Act I, Scene* i.

VIEWS OF LIFE AND DEATH

Our revels now are ended. These our actors,
As I foretold you, were all spirits, and
Are melted into air, into thin air;
And, like the baseless fabric of this vision,
The cloud-capp'd towers, the gorgeous palaces,
The solemn temples, the great globe itself,
Yea, all which it inherit, shall dissolve
And, like this insubstantial pageant faded,
Leave not a rack behind. We are such stuff
As dreams are made on, and our little life
Is rounded with a sleep.
—*The Tempest, Act IV, Scene* i.

Cowards die many times before their deaths;
The valiant never taste of death but once.
Of all the wonders that I yet have heard,
It seems to me most strange that men should fear;
Seeing that death, a necessary end,
Will come when it will come.
—*Julius Caesar, Act II, Scene* ii.

To-morrow, and to-morrow, and to-morrow,
Creeps in this petty pace from day to day
To the last syllable of recorded time;
And all our yesterdays have lighted fools
The way to dusty death. Out, out, brief candle!
Life's but a walking shadow, a poor player
That struts and frets his hour upon the stage
And then is heard no more. It is a tale
Told by an idiot, full of sound and fury,
Signifying nothing.
—*Macbeth, Act V, Scene* v.

O, that this too too solid flesh would melt,
Thaw, and resolve itself into a dew!
Or that the Everlasting had not fixed
His canon 'gainst self-slaughter! O God! God!
How weary, stale, flat, and unprofitable,
Seems to me all the uses of this world!
Fie on't! ah fie! 'Tis an unweeded garden,
That grows to seed; things rank and gross in nature
Possess it merely.
—*Hamlet, Act I, Scene* ii.

THE LESSONS OF PHILOSOPHY

Sweet are the uses of adversity,
Which, like the toad, ugly and venomous,
Wears yet a precious jewel in his head;
And this our life, exempt from public haunt,
Finds tongues in trees, books in the running brooks,
Sermons in stones, and good in every thing.
—*As You Like It, Act II, Scene* i.

The fool doth think he is wise, but the wise man knows himself to be a fool.
—*As You Like It, Act V, Scene* i.

Some are born great, some achieve greatness, and some have greatness thrust upon 'em.
—*Twelfth Night, Act II, Scene* v.

THE SEVEN STAGES OF LIFE

All the world's a stage,
And all the men and women merely players.
They have their exits and their entrances,
And one man in his time plays many parts,
His acts being seven ages. At first the infant,
Mewling and puking in the nurse's arms.
And then the whining school-boy, with his satchel
And shining morning face, creeping like snail
Unwillingly to school. And then the lover,
Sighing like furnace, with a woeful ballad
Made to his mistress' eyebrow. Then a soldier,
Full of strange oaths, and bearded like the pard,
Jealous in honour, sudden and quick in quarrel,
Seeking the bubble reputation
Even in the cannon's mouth. And then the justice,
In fair round belly with good capon lin'd,
With eyes severe and beard of formal cut,
Full of wise saws and modern instances;
And so he plays his part. The sixth age shifts
Into the lean and slipper'd pantaloon,
With spectacles on nose and pouch on side,
His youthful hose, well sav'd, a world too wide
For his shrunk shank; and his big manly voice,
Turning again toward childish treble, pipes
And whistles in his sound. Last scene of all,
That ends this strange eventful history,
Is second childishness and mere oblivion,
Sans teeth, sans eyes, sans taste, sans everything.
—*As You Like It, Act II, Scene* vii.

For any subject not found in its alphabetical place see information

KING LEAR WITH CORDELIA DEAD IN HIS ARMS

LEAR. *Howl, howl, howl, howl! O you are men of stones;*
Had I your tongues and eyes, I'd use them so
That heaven's vault should crack. She's gone for ever!
I know when one is dead, and when one lives;
She's dead as earth. . . .

This feather stirs; she lives! if it be so,
It is a chance which does redeem all sorrows
That ever I have felt. . . .

A plague upon you, murderers, traitors all!
I might have saved her; now she's gone for ever!
Cordelia, Cordelia, stay a little. Ha!
What is't thou say'st? Her voice was ever soft,
Gentle, and low, an excellent thing in woman.
KING LEAR, *Act V, Scene* iii.

MACBETH AND LADY MACBETH

LADY MACBETH. *Why did you bring these daggers from the place?*
They must lie there: go carry them; and smear
The sleepy grooms with blood.

MACBETH. *I'll go no more:*
I am afraid to think what I have done;
Look on't again I dare not.

LADY MACBETH. *Infirm of purpose!*
Give me the daggers: the sleeping and the dead
Are but as pictures: 'tis the eye of childhood
That fears a painted devil. If he do bleed,
I'll gild the faces of the grooms withal;
For it must seem their guilt.
MACBETH, *Act II, Scene* ii.

SHYLOCK AFTER HIS DAUGHTER'S FLIGHT

SALANIO. *I never heard a passion so confused,*
So strange, outrageous, and so variable,
As the dog Jew did utter in the streets:
'My daughter! O my ducats! O my daughter!
Fled with a Christian! O my Christian ducats!
Justice! the law! my ducats, and my daughter!
A sealed bag, two sealed bags of ducats,
Of double ducats, stolen from me by my daughter!
And jewels, two stones, two rich and precious stones,
Stolen by my daughter! Justice! find the girl;
She hath the stones upon her, and the ducats'.
SALARINO. *Why, all the boys in Venice follow him,*
Crying, his stones, his daughter, and his ducats.
THE MERCHANT OF VENICE, *Act II, Scene* viii.

THE SONG OF AUTOLYCUS, THE MERRY PEDDLER

Lawn as white as driven snow;
Cyprus black as e'er was crow;
Gloves as sweet as damask roses;
Masks for faces and for noses;
Bugle bracelet, necklace amber,
Perfume for a lady's chamber;
Golden quoifs and stomachers,
For my lads to give their dears:
Pins and poking-sticks of steel,
What maids lack from head to heel:
Come buy of me, come; come buy, come buy;
Buy, lads, or else your lasses cry:
Come buy.
THE WINTER'S TALE, *Act IV, Scene* iv.

For any subject not found in its alphabetical place see information

SHAMROCK. "You tell us that there are three gods, and yet one," wonderingly said the natives of Ireland when the holy Saint Patrick was preaching the gospel to them 1,500 years ago. "How can that be?"

For answer the saint bent over and plucked a shamrock growing at his feet. "Do you not see," he said, "how in this wild flower three leaves are united on one stalk, and will you not then believe what I tell you, that there are indeed three persons and yet one God?"

Historians have relegated many stories about Saint Patrick to the realm of myth, but the shamrock remains the emblem of Ireland, proudly worn by Irishmen the world over on Saint Patrick's Day, March 17. The true shamrock (in Irish *seamrog*, meaning "three-leaved") is the hop clover, which much resembles our common white clover, except that the flower is yellow instead of blue-green. Large shipments of shamrocks are brought to the United States for Saint Patrick's day.

Several other three-leaved plants are loosely called shamrock, including the white clover and the wood sorrel. Scientific name of true shamrock, *Trifolium minus*. Flowers yellow, in dense head, many florets; calyx 5-toothed, 10 stamens; leaves palmately trifoliate.

SHANG'HAI, CHINA. Nowhere in the world is there another city like Shanghai. In the streets of this twin-city—for it is two cities, one European and one Chinese—the East and the West jostle each other, and, living side by side, each knows nothing of what the other is doing. The European city, in which collect merchants, missionaries, and adventurers from all the countries of the world, is clean and handsome, with splendid shops and houses, broad streets, and many trees. The Chinese city, in which herd nearly a million Chinese, is, except for a few streets, unbelievably dirty and squalid. Each city is distinct, with its own boundaries, government, and courts, so that foreigners are not subject to the laws of China.

Nearly every nation of the world has contributed its share to the cosmopolitan life of this great seaport at the mouth of the Yangtze River. The streets of the "international settlement," policed by black-bearded Sikhs from India, are scarcely less colorful than those of the native city, where Chinese from every province in the country come to transact business. Nowhere is Shanghai's strange medley of races better shown than along the wide waterfront, where European taxicabs, carts drawn by Mongolian ponies, and Chinese rickshaws, sedan chairs, and wheelbarrows await their fares.

Foochow Road in the native city is considered by the Chinese one of the most imposing thoroughfares in the whole country. It is lined with gorgeous shops and restaurants, which are so brilliantly lighted at night that the Chinese call it their "Great White Way." Of special interest to foreign tourists is the quaint old Willow Tea House, which furnished the design for the beautiful willow-ware china.

The great productiveness of the country surrounding Shanghai and its strategic position at the mouth of China's greatest river make it one of the most important seaports in the Far East. Railroads lead inland from Shanghai and 40 miles away is the Grand Canal, China's great waterway between north and south. By these routes come for export a vast amount of tea, rice, cotton, wool, beans, wheat, silk, and hides. Chief among the imports are cotton, yarns, and cloth, coal, sugar, metals, machinery, and kerosene. Shanghai has a larger commerce than all other Chinese ports. Population, about 1,200,000.

SHANTUNG (*shän-tụng'*), CHINA. On the east coast of China, looking across the Yellow Sea to Korea and Japan, lies Shantung—a mountainous promontory 100 miles wide and 200 long reaching out from the alluvial plains built of the silt brought down by the treacherous Hwang or Yellow River. Into this province, about the size of Iowa, are crowded 30,000,000 Chinese. It is one of the most densely populated districts in the world.

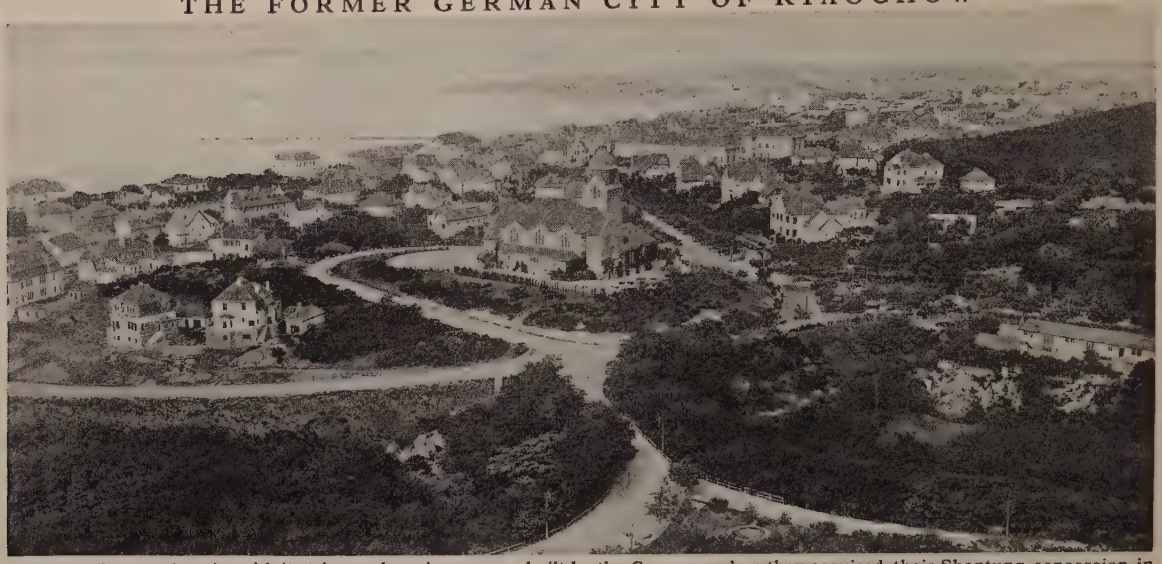
"East of the mountains" is what the word Shantung means. The highest of the few scattered peaks toward its western boundry, T'ai-Shan, is the most sacred spot in all China. In this province China's two most famous men were born, Confucius and Mencius, philosophers and sages.

It is the land of "shantung" and of "pongee" silk, made from the wild silkworm cocoons. Silk, coal, and iron, and the "coolie" laborer constitute its chief sources of wealth. To help the Allies in the World War, 150,000 Shantung coolies traveled all the way to the Western Front. And they did splendid work there, in salvage and construction tasks. Their keen observation of every phase of life which they saw in France broadened in turn their life of patient unending toil at home, of trying to produce three crops of rice, cotton, or millet every two years from a soil impoverished by centuries of use.

In 1897–98 Germany acquired a concession of territory in Shantung—the bay of Kiaochow and fishing village of Tsingtau—as a penalty paid her for the killing of two German missionaries. Shortly after, Weihaiwei, on the north coast of the promontory, was leased to England. Germany expended money and labor without stint and Tsingtau became a great port and military and commercial center, with golf courses, modern hotels, clean streets, and miles of the finest motor roads. The whole province came largely under German economic control. Other Shantung cities were modernized, including Tsinan, the capital, and railroads were built with German capital to connect them. The mining operations begun by Germany and continued by Japan are still in the early stages of development, but the presence of coal and iron together with a large supply of cheap labor give promise that Shantung will become one of the chief iron and steel centers of eastern Asia.

In payment for her capture of Kiaochow, during the World War, Japan demanded of China, and was given by the Peace of Versailles, the German economic concessions in Shantung—railways, mines of all sorts,

THE FORMER GERMAN CITY OF KIAOCHOW



This neat little garden city with its trim modern homes was built by the Germans when they acquired their Shantung concession in 1898. After the World War, it passed under Japanese control. It was from this port that 150,000 Chinese coolies embarked for France during the World War to work behind the battle lines.

and submarine cables. This action brought bitter protests from China, and in December 1922 Japan evacuated the province and gave up all her interests, in fulfillment of an agreement made at Washington after the Armament Limitation Conference.

Chefoo, a port on the north coast, is increasing in importance. Most of the province's silk is exported through this port. Because its climate is fine, as is that of Tsingtau, Chefoo has become quite a summer resort, especially liked by Europeans stationed in China.

SHARKS. Sharks are the beasts of prey of the sea, and the weapons and ferocity that seem to us so cruel simply indicate the means by which they get their living. Naturalists set the sharks (and their near relatives the rays) apart in a group of fishes called *Selachians*, the mark of which is that in them the skeleton is not bony, as in most other fishes, but its parts are composed of tough cartilage (gristle). Another notable difference between Selachians and bony fishes is that in sharks the skin is not thin and protected by a coat of scales, but is a regular hide, filled with minute flinty particles whose crowded points come through and stud the surface like fine sandpaper. This skin makes the leather called "shagreen," used as a polisher. Sharks are the lowest in rank—that is, simplest in structure—of all the true fishes; they are also the oldest in history, for their remains are found in the earliest rocks (Devonian) that have kept any fish fossils for our study. A few of the most ancient kinds of sharks are still to be found, little changed from their ancestors who swam in the Paleozoic ocean millions of years ago.

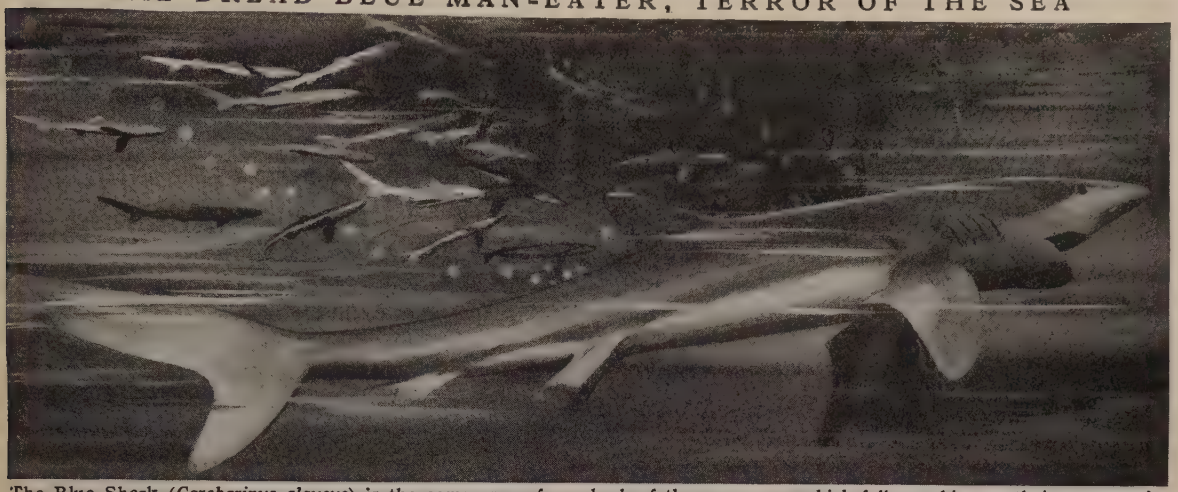
Sharks now exist in an immense variety of size, aspect, and habits. Some, like the small gray dogfish, so destructive of fishes and fishermen's nets along the northeastern coast of America, are only three or four feet long; while a certain species of the South Seas attains a length of 40 feet, and in rare instances 50 feet. Some extinct species seem to have been even more gigantic. All are more numerous in warm than cold seas, many species belonging wholly to the tropics.

Judged by habits, sharks are of two sorts. One kind, called "ground sharks," seek their food close to the bottom, but not in very deep water; while the other kind remains near the surface and captures its prey there. The former are blunt-headed, sluggish, and harmless (to us), prowling about in search of shellfish, sea-anemones, and the like, on which they feed. Their mouths are lined with rounded blocks of a hard substance called "pavement teeth," enabling them to crush and grind the hardest mollusk's shell or toughest crab. This class is the fewest in number and most ancient in character of all Selachians.

The Eating Apparatus of the Shark

The great majority of sharks are surface hunters, and swift and powerful swimmers. Their mouths do not lie at the end of the usually pointed snout, as in other fishes, but some distance back of it on the underside of the head. These mouths are large and furnished with thin sharp-pointed cutting teeth, often notched along the edge, so that the row of them looks and acts like a curved saw. In many sharks these teeth exist in several rows, one behind the other, right around the mouth; and when those in the front row are broken or fall out, the next row moves forward to take their place. Muscles of enormous strength work these horrid jaws; so that it is not surprising to learn that a small shark will chop a stout fish into pieces, or that a big one may bite a man's leg off at one stroke. The underside position of the mouth of

THE DREAD BLUE MAN-EATER, TERROR OF THE SEA



The Blue Shark (*Carcharinus glaucus*) is the common surface shark of the open seas, which follows ships on their voyages for weeks, collecting especially about whaling vessels to devour the carcasses of whales. It is slaty blue above and white underneath and more slender and graceful than most other sharks. This picture of a female shark with its young is from a group in the American Museum of Natural History, New York.

course compels the shark to turn on its back and seize its victim from beneath, but that is easy, yet has more than once been the saving of some hapless man. Some pearl-divers carry a long knife and stab the monster as it rolls over with open jaws.

Some Queer Shapes

Sharks have good eyes and noses—it is believed they can follow a line of scent in the water; but they hear little, if anything, to aid them in their hunting. One big slender fellow (the "hammer-head") has his head so broadened by two big side-lobes that it resembles the head of a hammer. Another, the "thresher," has a very long tail with which it lashes about in a school of fish until dozens of them are killed, which it then swallows at leisure. The dangerous man-eaters are mostly denizens of tropical seas and are often only nine or ten feet long. But some of the worst frequently wander northward, so that we hear now and then of a bather seized, or at least terrified, even on our own coasts, as happened a few years ago in New York Bay.

The young, produced annually, are few, and in many species are born alive. In others they come from eggs that are encased in tough and leathery envelopes. These usually bear stringy appendages that curl like tendrils about seaweeds, and so prevent the egg from drifting ashore before it hatches. These egg-cases—some of which are oblong while certain others are twisted with a spiral cone—and the similar ones of the rays are often cast up empty on the beach, and are called "sea purses."

Sharks are hunted, especially in the waters of the Far East, for the sake of the oil in their great livers, and also for the shagreen. Their flesh is used as food. Among the most common families of sharks are the following: hammerhead, *Sphyrinidae;* threshers, *Alopiidae;* tigers and "man-eaters," *Galeidae;* dog-fishes, *Squalidae.*

SHAYS' REBELLION. The most important of all the disturbances in the "critical period" following the American Revolutionary War was Shays' Rebellion of 1786–87 in western Massachusetts. For six months part of that state was in armed revolt against the constituted authorities.

Among the things objected to by the agitators were the heavy taxation on land, the cost of law proceedings, the high salaries paid to state officials, the oppressive rulings of the courts, and the aristocratic character of the state senate. It was one of the first notable movements of democracy against aristocracy and class privilege in the history of the United States. In several towns the courts were hindered from sitting by armed mobs. The Supreme Court session at Springfield was broken up by Shays and his followers, in spite of the presence of the militia. Some concessions were made by the legislature; but the agitation was not checked until the militia fired upon an expedition which Shays was leading against the Federal arsenal in Springfield. The followers of Shays then fled, for the most part, from Massachusetts. Fourteen of the leaders were condemned to death for treason, but were pardoned. Daniel Shays himself was an honest and well-meaning man, and he was later pensioned for his services during the Revolutionary War.

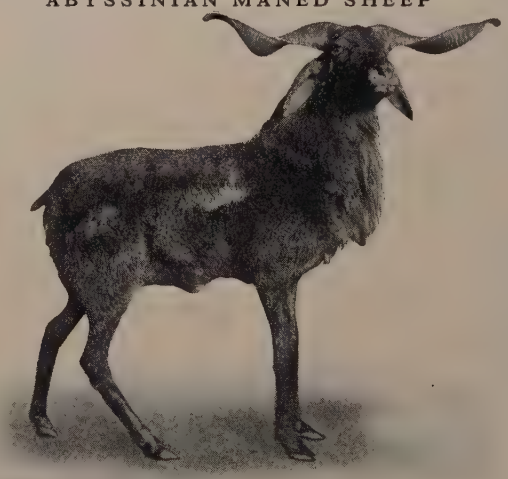
This rebellion was one of several disturbances in different states growing out of the unsettled financial and political conditions following the Revolutionary War. It was also one of the chief events leading to the formation of the new constitution of the United States. The upper classes especially felt that there should be formed at once a central government strong enough "to ensure domestic tranquillity." Just grievances should be remedied, but, as Washington put it, "we should have a government by which our lives, liberties, and properties may be secured."

The ANIMAL FRIEND that GIVES US HIS WOOLEN COAT

SHEEP. There are few animals more useful to man than the sheep, and many primitive peoples would find it very hard, if not impossible, to exist without it. The sheep was among the first animals to be domesticated—perhaps it was the very first; and flocks of sheep were found in many parts of Europe and Asia before the dawn of history. The warm fleecy pelt of the sheep provides primitive men with garments for winter; its skin when properly dressed makes leather for many purposes; its wool is woven into cloth of many varieties; it yields sweet nourishing milk; and its flesh, known as lamb and mutton, is one of the finest of meats.

In the wild state sheep are found only in mountainous regions of the Northern Hemisphere. Every group of mountains in Asia possesses one or more species of sheep peculiar to it, but Europe, Africa, and America possess only one species apiece. Wild sheep are never found in lowlands. They ascend mountains sometimes to heights where no other animals except goats are found.

ABYSSINIAN MANED SHEEP



Long hair instead of wool and a longish mane distinguish the Abyssinian breed of sheep. The ram has those long spiral horns.

Sheep and goats are closely related to each other, and in the wild state are not easily distinguished by their outward appearance. Sheep differ from goats in the possession of a flat forehead, triangular horns, and no beard; they also have a tear-bag or pit beneath the inner corner of the eyes, which goats lack.

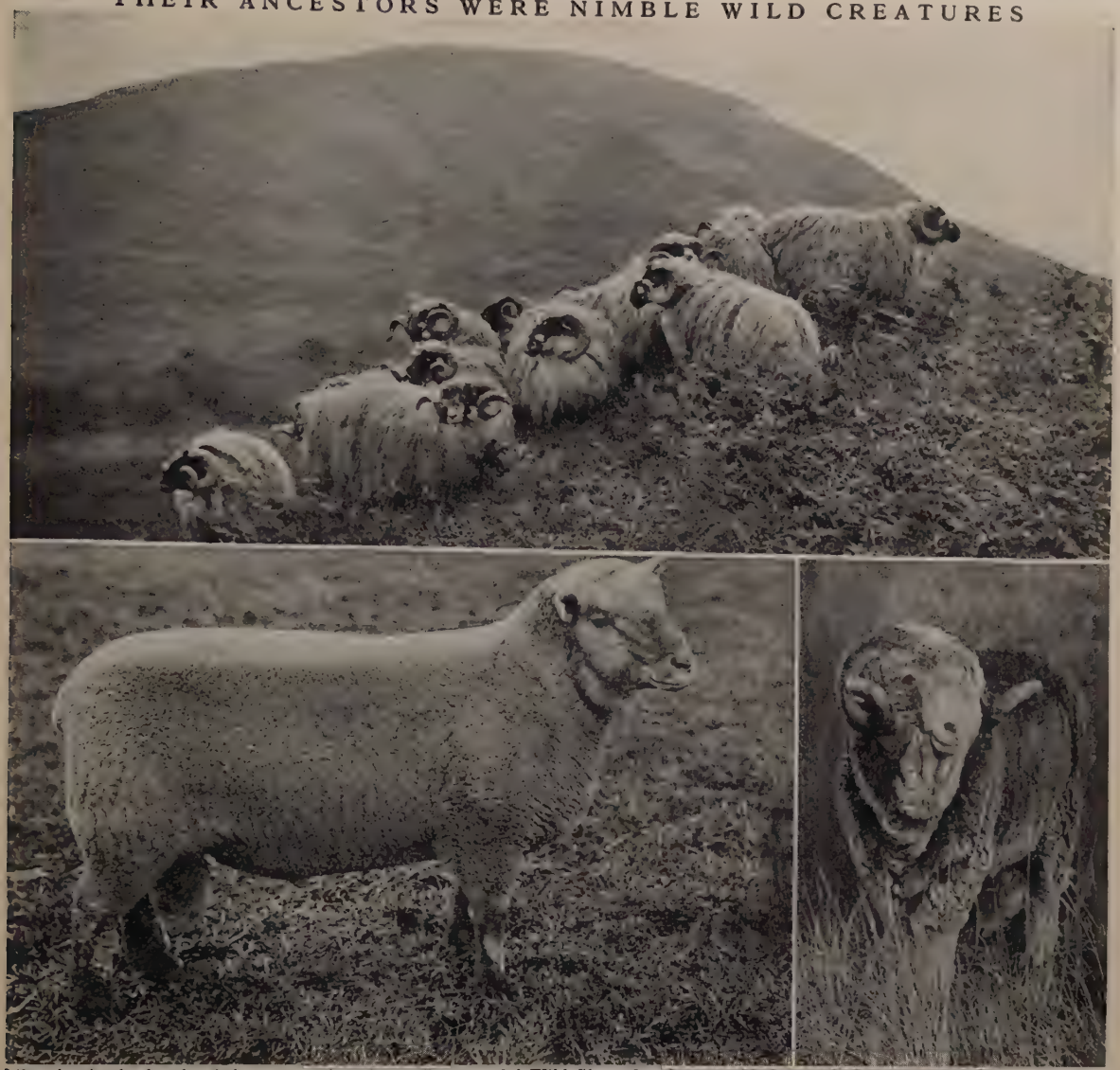
Clever Things Wild Sheep Do

Sheep live in flocks and follow a leader, usually an old ram, as the male sheep is called. They are very timid and flee at the approach of danger, but they can fight, and a large ram will even at times contest with a bull. Ewes, as the females are called, frequently charge dogs that threaten the lambs. When two or more ewes with lambs are together and are attacked by a dog, the lambs follow one of the ewes while the remaining ewes attack the dog. The dog easily dodges the charges of the sheep, but while he is so engaged the ewe and the lambs escape.

Domestication has reduced the sheep to entire dependence on man for food and protection. The timidity and cowardice of a flock of domestic sheep is pitiful. A sheet of paper blown by the wind or a clap of thunder will throw a large flock into panic. A fire in a sheepfold usually destroys most of the sheep, since all efforts to drive them out are futile. Even after they have been driven out they are almost certain to run back into the burning building unless prevented from doing so. The lambs, one or two at a birth, are born in the spring, and are capable of following the mother soon after birth.

The bighorn, or Rocky Mountain sheep, of North America is one of the largest varieties of wild sheep (*see* Bighorn). There are several allied species, some of them in Asia. It seems probable that all the wild sheep in Asia and America are closely related, although there are great differences in size and color. The mouflon, the only representative of the sheep family native to Europe, is found on the islands of Corsica and Sardinia. The aoudad, or Barbary sheep, is found in northern Africa, in the Atlas Mountains. It is a large animal, resembling the goats. It has large horns and a manelike growth of long hair on the breast and forelegs. The argali of Mongolia, whose

THEIR ANCESTORS WERE NIMBLE WILD CREATURES



Like clay in the hands of the potter, the wiry, agile, graceful Wild Sheep has been molded to suit human convenience—into the many woolly, short-legged, clumsy breeds of Domestic Sheep. Above is a group of Scotch Blackface Sheep, which make excellent mutton but produce an inferior grade of long, coarse, hairy wool. Below, to the left, is the aristocratic pure-bred Sussex or Southdown, with its fine short fleece. On the right is a Merino ram. The Merinos are not good mutton-producers, but are considered the greatest wool-producing breed in the world.

enormous spreading horns are a wonder to all beholders, and the "Marco Polo sheep" of the Pamir plateau, whose horns though less massive have a wide spread, are the largest members of the sheep family. The latter gets its name from the famous Venetian traveler of the 13th century, who first described it.

There are several other varieties of wild sheep in Asia, such as the sha or urial, which has a wide range in southern Asia; the burrhel or blue sheep, which is found in the Himalaya Mountains; and the sair whose range is in the Altai Mountains. The burrhel possesses many points, particularly its smooth horns, in common with the goats and seems to be a connecting link between the goats and the sheep.

The origin of the domestic sheep is unknown, but it is almost certain that several, and perhaps many, varieties of wild sheep were tamed, and that the modern varieties of domestic sheep are the result of cross-breeding. However this may be, it is noteworthy that the domestic sheep bear little resemblance to any of the existing wild species. For example, most of the domestic breeds are hornless, though some have developed four and even eight horns, and nearly all bear wool instead of the coarse hair of the wild sheep.

The commonest and best known of the domestic breeds is the Merino, which originated in Spain in the 15th century. It is famous for the large quantity

and fine quality of wool it produces. The Merino has been used to improve most, if not all, of the other European short-wool breeds.

In the beginning of the 19th century Merino rams were imported into America, often at fabulous prices, and the flocks gradually spread westward over the fertile lands of the Great Lakes region, and southward to the Ohio. When the land in this region became too valuable to make the sheep industry profitable at the prevailing prices of wool, large flocks were established throughout the west, from Montana to Texas, and over the Rocky Mountains to the Pacific coast. More than two-thirds of the sheep of the United States are found west of the Mississippi. Since 1910 the number of sheep in the country has steadily decreased, despite the great advance in the price of wool and mutton.

The Best Wool in All the World

The American Merinos produce the best wool in the world, and for many years this breed predominated, but gradually the demand for a better mutton-producing sheep than the Merino resulted in the introduction of various English breeds. Among these the Cotswold was long a favorite, but many other varieties were imported from time to time, and flocks of Southdowns, Shropshires, Hampshires, and Oxford Downs are now found in many parts of the country. They produce wool of medium and long fiber. The "improved Leicester," developed in England, is the progenitor of most long-wool breeds, such as Lincolns and Cotswolds.

The Delaine Merino, from which the fine Delaine wool is derived, is an American product; the breed was developed in western Pennsylvania and eastern Ohio. "Saxony," another popular wool of excellent quality, is derived from Merino sheep which were introduced into Saxony from Spain. The Rambouillet breed, which originated in France and is a descendant of the Spanish Merino, is larger than the Merino and has recently become popular with American sheep-breeders. The Cheviot is a Scottish mountain sheep producing a medium-length fine wool.

The fat-tailed sheep, found in many parts of Africa and Asia, is remarkable for the quantity of fat which accumulates in its tail; in some instances the tail weighs from 50 to 80 pounds. The shepherds fasten a board to the underside of the tail, and sometimes attach wheels to the board to enable the sheep to carry its tail without injury. The fat is highly esteemed as a delicacy and is often used instead of butter. The new-born lambs of other Asiatic sheep, such as the Astrakhans and Karakul breeds, have a very fine wool twisted in spiral curls which is in high demand as fur.

The chief sheep-raising countries of the world are Australia, Argentina, Russia, the United States, South Africa, India, the British Isles, Uruguay, New Zealand, and Spain. (*See also* Wool.)

Sheep belong to the genus *Ovis*, of the family *Bovidae*. The domestic sheep is *Ovis aries*.

Sheffield, England. All over the world "Sheffield" means fine cutlery, such as knives, razors, scissors, surgical instruments, together with mathematical instruments, files, saws, and engineering tools of all kinds. Heavy steel, too, is manufactured there—armor plate, rails, engines, machinery, guns and shells—and cast-iron articles, such as stoves and grates, as well as silver and brass ware. Next to the mayor, the highest dignitary in town is the Master Cutler of the ancient Cutler's Company, which exercises jurisdiction over trademarks on metal goods and over all persons in business in the district of the West Riding of Yorkshire, in which Sheffield is situated. The famous "Sheffield plate" (silver) is no longer manufactured, the process having been abandoned in favor of cheaper methods.

Sheffield's preëminence in the steel industry is due in part to its situation in the Yorkshire-Derbyshire coal field; yet iron was smelted with charcoal in the district probably in Roman times—certainly by the time of the Norman Conquest—and Sheffield blades were famous long before "pit coal" was used in the manufacture of iron and steel. The Miller in Chaucer's 'Canterbury Tales' carried a "Sheffield thwytel" or knife. It was a Sheffield man, Benjamin Huntsman, who in 1740 introduced the process of making crucible steel from bar or blister steel, which is still used in making Sheffield fine cutlery. Henry Bessemer established his first steel works in Sheffield, by the aid of Sheffield capital, and much Bessemer steel is still manufactured there.

Like some of the Pennsylvania steel towns, Sheffield is smoky and dirty, but it is delightfully situated at the base of hills on the river Don, a tributary of the Humber. Its most interesting public building is St. Peter's Church, originally built in Norman times and burnt during the wars of Edward III with the barons, but rebuilt; the oldest standing part, the tower, dates from the 14th century. Sheffield University, founded in 1905 by a local steel manufacturer, comprises, besides the departments of medicine, arts, science, commerce, etc., a flourishing technical school with metallurgical laboratories and shops. Population, about 495,000.

Shell. Among the many things which make the seashore a place of wonder and delight are the shells, of the most curious and interesting shapes, with which it abounds. Some, washed up by the tide, are empty; but others contain the living tenants, which often rival the shells in interest.

But shells are not confined to the seashore. They are found in all parts of the ocean, sometimes buried in the mud and ooze of the ocean bed, or floating airily on the surface of the water a thousand miles or more from shore; and the dim quiet of the Arctic waters and the brilliant shimmer of the tropic seas alike conceal their millions of interesting creatures. Nor is it necessary to go to the sea for shells, for they abound in fresh-water ponds and streams and on land. They are even found in the desert beds of

dried-up seas, on lofty mountains, and far down in the depths of the earth, giving their mute witness to the life of long-past ages.

Shells as we know them are the coats of armor that mollusks and other animals form to protect themselves. The shell is composed of substances secreted by the glands of the animal's back. It consists largely of carbonate of lime, which is the basic material of limestone, chalk, and marble; and lime is often obtained commercially by burning piles of shells. As the animal grows in size, its shell increases in thickness and extent. The lines of growth are usually clearly marked by the ridges running parallel to the outer or free edge, as in the oyster and clam. The other ridges and protuberances on a shell are caused by corresponding projections on the "mantle," or muscular tissue which grows from the back. (*See* Mollusks.)

THE BEAUTIFUL MUREX

These shells are from mollusks of the *Murex* genus, remarkable for the beauty and variety of their spines and still more so for the fact that some of the animals yielded the famous "royal" or "Tyrian" purple of the ancients.

The Shell Creature's Triple Coat

The mollusk shell consists of three layers. The outer surface is covered with a thin layer of horn-like material which contains no lime. Beneath this is a layer of very small prisms of carbonate of lime. Lastly, forming the internal layer, is the nacre, or "mother-of-pearl," composed of alternate layers of carbonate of lime and a horny substance arranged parallel to the surface. The free edges of these layers refract the light and thus produce the beautiful iridescent appearance which we prize so highly. The outside of the shell may be white, black, brown, tan, purple, red, or rose, but usually some pattern combining several colors, tints, or shades. The color of the interior is usually paler and more delicate than the exterior, and often it is splendidly prismatic. Shells of the tropics are usually more highly colored than those of temperate zones.

The Scorpion shells have long curved fingers that make them look like the animal for which they are named.

When you look at a collection of shells you are amazed at the infinite variety of shapes represented. Many of them so closely resemble other natural objects or objects of human invention, that they are known as "miter," "harp," "helmet," "top," "razor," "turban," "cone," "basket," "lamp," "frog," "trumpet," "ear," and "slipper" shells. Most are marked with ridges, folds, frills, or spines, corresponding to the growth or structural peculiarities of the animal that lived in them.

But despite the great variety of these forms, you will soon notice that they nearly all fall into one of two great groups—those having a shell in one piece, like the snails, and those having a shell in two pieces hinged at the back, like the oysters and clams. The one-piece shells are called "univalves" and the two-piece shells "bivalves." All the land shells are univalves, but the shells found in the water may be either univalves or bivalves. Besides these two great classes, there is another kind which is much less common, in which the shell consists of eight overlapping plates connected by a leathery girdle. These "coat-of-mail" shells, the chitons, are found wholly in salt water. They cling to the rocks with extraordinary force, and when they are dislodged they promptly curl up like a pill bug, and must be put in salt water or on a moist surface before they will relax.

Among the common bivalves found on or near the seashore are the oyster, clam, mussel, scallop, cockle, razor shells, and the teredo or shipworm. All of these are mollusks, but other interesting bivalves which are not mollusks also live near the shore, usually in deep water. These are the "lamp shells," or brachiopods, which are really shelled worms.

Lamp shells are among the oldest of animal groups. Millions of years ago they were more abundant than now, but in structure they are nearly the same as then. The larger of the two valves resembles the bowl of an ancient lamp, and the circular hole at one end seems to be made for a wick. But the hole is really used to help fasten the animal to some anchorage, for through it runs a long stem. Lamp shells vary in size from two inches to a sixteenth of an inch in length. In color they are waxen white, brown, or brilliant crimson.

The largest of the shells is the giant clam of the Indian and Pacific Oceans, which grows to be from two to three feet in diameter and sometimes weighs four hundred pounds. Single valves of these shells are sometimes used as receptacles for holy water at

the doors of Catholic churches. So hard do the shells become that the natives of the Caroline Islands hew axes out of them. Divers for pearls and sponges are said to have been trapped by this great shell, and to have cut off hand or foot as the only way to escape drowning.

Most of the univalve shells are more or less conical in shape, though sometimes they are much flattened. The snail and whelk class have conical tubes coiled in a spiral, usually from left to right. Another class is shaped like a hollow cylinder, open at both ends, and looking much like an animal's tooth, whence they are called "tooth shells."

Everyone is acquainted with the beautifully conical shape of the conch shell, found on the Florida coast and the West Indies. The "queen conch" is the largest shell native to any part of the United States, sometimes measuring a foot long. These shells are used for parlor ornaments, and for dinner horns on Southern plantations. Loads of them are shipped yearly to Great Britain to be ground to pieces and used in the manufacture of porcelain.

Because of their beautiful coloring, many shells are manufactured into articles of adornment, such as brooches, bracelets, necklaces, and buttons (*see* Buttons); or they may be used for inlaying furniture, musical instruments, and other articles. Among those much in demand for such purposes is the abalone or "earshell," found in greatest perfection on the shores of California, where it sometimes grows ten inches long. This shell is a true spiral, but it is flat and therefore often mistaken for a bivalve. The inside is beautifully iridescent, and the exterior also takes a high polish. From these shells comes a large part of the mother-of-pearl of commerce, and great quantities are gathered annually for making pearl buttons. They cling to the rocks with terrible power and many a lonely fisherman has been drowned, it is said, by getting his fingers caught between the shell and the rock.

The beautiful "turban shells" from the Indian Ocean, the Philippines, and the Sea of Japan are also in great demand for making buttons and ornaments. They are large heavy shells, with rounded whorls shaped like a turban. The giant of the family is the "green turban" or "green snail," which the monarchs of Scandinavia used to mount in silver and use for drinking cups. The "Turk's cap" is a beautiful variety, from three to five inches across.

SUCH BORES!

Bivalves have various accomplishments. Some can swim, some jump, some burrow. These Piddocks are borers in solid stone.

SCREW SHELL

A little spiral tower of strong and beautiful design.

The "helmet shells" are notable for their use as cameos. They have a dark coat under a pale outer layer, so that figures carved on them stand out in bold relief against the black, red, pink, or orange background. The best for this purpose is the "black helmet," which is found on the Atlantic coast from North Carolina to the West Indies. Formerly all cameos were cut from stones, but many of the finest specimens of the last century have been cut from these shells (*see* Cameo).

Among many primitive peoples, as among the North American Indians, shells were used for money. The most widely used shells for this purpose are the beautiful cowries or "Venus shells," which exhibit an endless variety of color and shape. The "ringed cowry" is still the usual currency in a few of the more remote of the Indian and Pacific islands, and some tribes in the interior of Africa use strings of the "money cowry." Along the west coast of Africa this was the usual currency until past the middle of the 19th century, and traders made large fortunes by gathering these shells in the Indian or Pacific Oceans and exchanging them for ivory and other valuable goods in Africa. Where they are still used, their value ranges from 2,000 to 3,000 shells to the dollar. In one of the tribes of Africa the king's revenue was estimated at 30,000,000 shells a year, and from 20,000 to 60,000 cowries was the price of a wife.

The currency of the American Indians, known as "wampum," consisted of cylindrical fragments of quahaug, whelk, and periwinkle shells, rubbed smooth on stones and strung like beads on fine strands of skin. The white beads were generally rated at only half the value of the purple beads, made from the quahaug or hard clam. A six-foot string was worth from five to ten shillings. Wampum was the accepted medium of trade with the Indians until well into the 18th century, and a belt of wampum was given to bind every treaty. Necklaces and belts of wampum were also used as ornaments.

Shells, properly so called, are to be distinguished from the hard shield which covers such animals as the tortoise, the lobster, and the crab. This thick crust is called a "carapace," and is a thickening of the skin rendered solid by deposits of the same carbonate of lime of which mollusk shells are formed, and intermediate between shell and bone in general composition and character.

Here are shells from far and near: 1. Abalone or Ear Shell. 2. Crusader's Scallop. 3. Turk's Cap. 4. Coil Shell of the Pond Snail. 5. Worm Shell. 6. Distaff Spindle. 7. Two Auger Shells. 8. Arched Slipper Shell. 9. Marbled Cone Shell. 10. Showy Chiton. 11. Watering Pot Shell. 12. Fossil Lamp Shell. 13. Spiny Frog Shell. 14. Camp Olive Shell (see the tents!). 15. Tiger Top Shell. 16. Harp Shell. 17. Pearly Nautilus. 18. Tiger Cowry. 19. Channeled Basket Shell. 20. Painted Thorny Oyster. 21. Great Triton or Triton's Trumpet.

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SHELLEY, PERCY BYSSHE (1792–1822). "A beautiful and ineffectual angel, beating in the void his luminous wings in vain"—so the great English critic Matthew Arnold characterized Shelley. The poet of clouds and sunsets and rainbows, of the swift wind, of the blue depth of the boundless sky, of the soaring skylark, Shelley seemed more at home in the heavens than on the earth. And still the great purpose of his life was not to soar among the clouds and write beautiful poetry. His ruling passion was to make the world better, to free mankind, "to purify life of its misery and evil." His work was ineffectual, for his schemes for reform were impractical and he knew little of real life; and in this lies the tragedy of his life. As a reformer he is almost forgotten; while as a poet he ranks among the highest in English literature. This is not the fame he desired.

A Dreamy and Romantic Figure

Even as a small lad Shelley was different from other boys. He was a beautiful youth, of slender figure, with complexion as fair as a girl's, and luminous large blue eyes, at times soft and dreamy, and at other times lit up with a wild and restless brilliance. Tales of romance and mystery fascinated him, and he delighted no less in the wonders of science, almost killing himself in chemical experiments. But his schoolmates could not understand why he took no interest in their games of cricket and football, and they called him "mad Shelley."

He imbibed the spirit of the French Revolution, which was still in the air, and rebelled against the tyranny that he saw everywhere, in government, in society, and in religion. He was expelled from Oxford University for writing an attack on religion, and his father, a baronet of an old Sussex family, understanding him as little as did the rest of the world, cast him off. Though without means, Shelley married a girl of 16, out of pity, because he felt that she, too, was oppressed and misunderstood. Shortly afterward he went to Ireland and tried to arouse the Irish to a sense of their wrongs, but without success.

His Tragic Death in the Sea

In 1818 he left England for Italy, where he spent the remainder of his life. In the meantime his first unhappy marriage had ended tragically, and he had married again, this time finding sympathy and understanding. During these years he wrote his beautiful poetic drama, 'Prometheus Unbound', and those matchless lyrics, 'The Cloud', 'To a Skylark', and 'Ode to the West Wind'. Here, too, he wrote his wonderful elegy, 'Adonais' on the death of his brother-poet John Keats, little knowing how soon his own life was to be cut short. He was drowned while sailing with a friend off the coast of Leghorn, a little more than a year after he had written these sadly prophetic lines:

> The breath whose might I have invoked in song
> Descends on me; my spirit's bark is driven,
> Far from the shore, far from the trembling throng
> Whose sails were never to the tempest given;
> The massy earth and sphered skies are riven!
> I am borne darkly, fearfully, afar;
> Whilst burning through the inmost veil of Heaven,
> The soul of Adonais, like a star,
> Beckons from the abode where the Eternal are.

In addition to those mentioned, Shelley's chief long poems are: 'Queen Mab' (1813); 'Alastor, or The Spirit of Solitude' (1815); 'The Revolt of Islam' (1817); 'The Cenci', a tragedy (1819); and 'Epipsychidion' (1821). Among the shorter poems are: 'Hymn to Intellectual Beauty' (1816); 'Mont Blanc' (1816); 'Ozymandias' (1817); 'Lines Written among the Euganean Hills' (1818); 'The Indian Serenade' (1819); 'The Sensitive Plant'; 'Arethusa' (1820); 'To Night' (1821).

SHERIDAN, GENERAL PHILIP HENRY (1831–1888). "Fighting Phil Sheridan" ranks with Grant and Sherman as one of the three great generals on the Union side during the War of the Rebellion, and he was the only one of the three who devoted his whole life to the profession of arms. Born in New York of Irish parents, Sheridan had secured as good an education as was afforded by the schools of the frontier state of Ohio, to which his parents had removed soon after his birth. Sheridan was ambitious and determined to succeed in life, and the outbreak of the Mexican War fired his ambition to be a soldier. He accordingly secured an appointment to West Point from which he was graduated in 1853. His first actual experience in warfare was gained in campaigns against the Indians in Texas and Oregon.

At the outbreak of the Civil War he was a first lieutenant, but, owing to the distinguished service which he rendered, his promotion was rapid, until he reached the rank of major-general of volunteers. His first services were in the West, where he distinguished himself in the battles of Perryville, Stone River, Chickamauga, and Chattanooga. At the battle of Missionary Ridge Sheridan led the men who charged up the hill, and he was one of the first to reach the crest.

When Grant, who had witnessed Sheridan's exploit at Missionary Ridge, was placed in command of the United States army, he gave Sheridan command of the cavalry of the Army of the Potomac. During the Wilderness campaign of 1864, Sheridan aided Grant by harassing the enemy and cutting their lines of communication.

In July of that year, when a strong Confederate force under Early had defeated the Federal army in the Shenandoah valley, penetrating into Maryland and threatening Washington, Grant saw the necessity of putting the department in the hands of an able general, and in August he placed Sheridan in command in the Shenandoah, with instructions to drive the Confederates out of the valley. So well did Sheridan succeed in carrying out these instructions that he put an end to the war in northern Virginia. He attacked Early at Winchester and again at Fisher's Hill, defeating him at both points, capturing 5,000 men and many guns, and pursuing him to Staunton. In recognition of this service Sheridan was made a brigadier-general in the regular army. Early's army receiving large reinforcements from Lee, again

advanced into the valley, surprised the Federal army at Cedar Creek in the early morning of October 19, and drove them back in confusion. Sheridan was absent from the army, having been to headquarters in Washington. He reached Winchester, 20 miles from Cedar Creek, on his return when he heard—

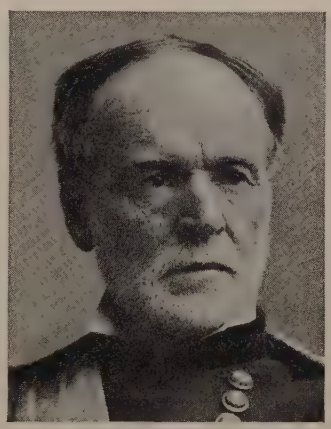
> The terrible grumble and rumble and roar,
> Telling the battle was on once more.

Hurrying forward, he reached the field. Speedily forming a line to stop the stragglers, he rode forward waving his hat and shouting, "Face the other way, boys; we are going back." Confidence was restored, the lines re-formed, and at 3 p.m. they moved back upon the enemy. The result was the total rout of Early's army, which was pursued up the valley for 30 miles. For this victory Sheridan was promoted to be major-general in the regular army, and received the thanks of Congress. The spirited statue in Washington by Borglum represents him at the moment when he is rallying his men on the Winchester road.

After devastating the Shenandoah valley, the granary of the Confederacy, so that it was said that a crow flying over it would have to carry its rations with it, Sheridan returned to the Army of the Potomac in March 1865. He was conspicuous under Grant in the operations before Petersburg and in the final battles preceding Lee's surrender. He compelled the evacuation of Petersburg by his superior generalship at Five Forks, where he entrapped and routed the Confederate troops under Pickett, capturing more than 5,000 prisoners.

After the close of the war Sheridan was placed in command in the Southwest near the Mexican border, where his benevolent attitude helped the Mexican patriots in their struggle against Emperor Maximilian, and later, of the department of Missouri, with headquarters at Chicago. When Sherman was made general, Sheridan was made lieutenant. He was the American military observer with the Prussian army in its invasion of France in the Franco-Prussian War in 1870. After Sherman's death the rank of general was conferred on Sheridan a few months before his own death. He was the last to hold this rank until it was conferred on Pershing.

As a field commander Sheridan was unapproachable. Filled with the ardor of battle, so that it was said he raged like a lion, his skill equaled his courage. He never lost a battle; and stood, after Grant and Sherman, one of the greatest Northern generals. Grant said: "As a soldier there is no man living greater than Sheridan. He belongs to the very first rank of captains, not only of our army, but of the world. I rank him with Napoleon, Frederick, and the great commanders of history."



GENERAL SHERMAN

Sherman, General William Tecumseh (1820–1891). Scarcely second to General Grant in bringing to a successful close the military operations of the Civil War was William Tecumseh Sherman, a brother of the statesman, John Sherman. Like Grant he was born in the then frontier state of Ohio a few years after that region had been freed from the menace of the Indian chief Tecumseh, and was named in memory of that noble warrior. Although the boy was left fatherless at an early age, he enjoyed greater educational advantages than did most boys of his time, due to the kindness of his father's friend, Thomas Ewing. After he had finished the academy in his home town of Lancaster, Ohio, he secured an appointment to the military academy at West Point, and was graduated from there in 1840 near the head of his class. He was immediately given an appointment in the United States army, and during the Mexican War saw active service in California. By the end of that war he was tired of military life, and resigned his commission to enter on a business, legal, and educational career. At the opening of the War of Secession we find him at the head of the state military academy of Louisiana. But his sympathies and duty lay with the North, so resigning his position, he hurried to Washington to offer his services to his country. The offer was accepted, he was commissioned a colonel, and commanded a brigade in the first battle of the war at Bull Run.

When the plans for the conduct of the war were matured, in August 1861, it was decided to send Sherman —now a brigadier-general—to the West, where he was placed in command of the Department of the Ohio. Immediately on taking charge of the department he reported to Washington that 200,000 men would be needed to carry on the campaign in the Mississippi valley. The North at that time had no adequate idea of the immensity of its task, and the papers said that Sherman was "crazy." Time proved that his estimate was correct, but he was sacrificed for the moment to the popular clamor against him and removed from his command.

Sherman's military genius was so great that he could not long be kept in the background. At the battle of Shiloh, April 6, 1862, he was in the thick of the fight. He had three horses shot from under him and was twice wounded, but he helped save the day for the Union army. For his services he was given the rank of major-general. Serious mistakes had been made at the battle of Shiloh, and the commander, Grant, had to endure much criticism. Grant wished to withdraw from the army entirely, but Sherman persuaded him to stay, reminding him of the storm of criticism he himself had weathered.

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Sherman did more than talk. He backed up his words with deeds, and in the Vicksburg campaign rendered valuable aid to Grant. At its successful conclusion he generously gave all the credit to his superior officer. When Grant, as a result of this campaign, was made commander of the armies of the United States, Sherman was appointed to fill Grant's position as commander in the West.

His Most Famous Campaign

It was in this position that he carried on the campaign on which his fame chiefly rests. On May 6, 1864, he left Chattanooga, Tenn., for Atlanta, Ga. It took him four months to cover the 135 miles between the two places, for in this campaign he met a foeman worthy of his steel in Gen. Joseph E. Johnston, the Confederate commander. Difficulties were about evenly balanced, but Sherman possessed the love and confidence of his men to a much greater degree than did his opponent. They knew that when they saw "Uncle Billy and his white socks" all was well.

Atlanta was reached on September 2. After clearing the city of its civil population and resting his men, Sherman started on his famous march of 400 miles "from Atlanta to the sea." For 32 days no news of him reached the North. He had cut himself off from his base of supplies, and his men lived on the country through which they passed. They covered a path 60 miles wide in their march, and in that path everything which they could not use but which might prove of use to the enemy was ruthlessly destroyed. When we consider this destruction is it any wonder that Sherman said that "war is hell"? Finally on December 20, Savannah, Ga., was reached and Sherman telegraphed to President Lincoln: "I beg to present you as a Christmas gift the city of Savannah, with 150 heavy guns and plenty of ammunition, and also about 25,000 bales of cotton."

The Surrender of Johnston

After a month's rest Sherman turned North with his army, expecting to join Grant near Richmond, the Confederate capital. But before he reached that place the Confederacy had collapsed. After receiving the surrender of General Johnston in North Carolina, Sherman marched on to Washington. He thus completed a march of nearly 2,000 miles through the enemy's country, one of history's greatest campaigns.

Having achieved such fame in the army, Sherman decided not to return to civil life. He remained as commander in the West until Grant was elected president. He was then made commander of the United States army, and given the rank of general, a rank which previously had been held only by Washington and Grant. He held the command of the army until 1884, when he resigned, after 23 years of continuous army service.

SHETLAND ISLANDS. In that far-away time when the Shetlands were inhabited by a short dark people called the Picts, the Romans named the islands *Ultima Thule*, "the farthest land," or end of the world. But to the Vikings of Norway and Sweden these northern outposts of the British Isles were near neighbors, a new kingdom where their "jarls" could taste of the fierce joys of piracy and feasting and combat. On every hand the traveler is confronted by some reminder of these ancient times—a burial mound, where the people of the Stone Age laid their chieftain to rest; a mysterious stone circle, marking the scene of some ancient Pictish rites; or a crumbling tower, a stronghold of this vanished race.

But there is also the charm of the present in this land of rolling seas and sweeping winds, where the waves dash like a charge of plumed cavalry against the high and brilliantly colored cliffs and have carved out from solid porphyry rock a great staircase known as Grind of the Navir, or Gate of the Giants. Everywhere is the sight or sound of the sea, for even the largest island is so broken by bays that no point is more than three miles from the ocean.

These are the compensations of the Shetlanders for their fogs and storms, their long dreary winter, and the bare and rugged isles where there are scarcely a hundred trees, and where little except potatoes, and scanty crops of oats and barley can be grown. Fishing has always been the leading industry, supplemented by the raising of cattle and sheep and the well-known Shetland ponies. Some woolen goods are manufactured from the fine Shetland yarns.

Situated 120 miles northeast of the mainland of Scotland, and about 200 miles west of Norway, the Shetlands number about 100 islands, of which approximately one-fourth are inhabited, and cover about 550 square miles. The most important is Mainland, which contains about two-thirds of the total area of the islands, and has at Lerwick, a thriving seaport, one of the finest natural harbors in Great Britain. The group was ceded by Norway to Scotland in 1468, and constitutes a Scottish county. Population, about 26,000.

SHILOH (*shī'lō*), BATTLE OF. On Sunday morning, April 6, 1862, General Grant was sitting at breakfast at his headquarters in southwestern Tennessee when he heard the rumble of cannon in the distance. He set down his coffee-cup half emptied and hurried away to the fiercest battle thus far fought in the Civil War, that of Shiloh or Pittsburg Landing on the Tennessee River. When he reached the vicinity of the little log church of Shiloh he found a serious situation. Gen. A. S. Johnston, the Confederate commander, had suddenly attacked the Union troops that morning with superior forces, surprised and captured their scattered outposts, and then engaged the main body. The Union resistance during the day was stubborn, but after 12 hours of fighting they were driven from all but one of the positions which they had held in the morning when the conflict began. The Confederates, however, had sustained an irreparable loss in the death of General Johnston.

That night both sides slept on the battlefield, ready to resume the conflict as soon as it was light.

For any subject not found in its alphabetical place see information

Under cover of the darkness fresh troops joined Grant's worn-out command, and on the next day the Union forces regained all that had been lost on Sunday. The Confederates fought stubbornly, but they were finally forced to withdraw, and the victory remained with the Union forces. But it was a victory bought at the terrible cost of 13,000 Northern men killed and wounded. The price was too great for the advantage gained, and the criticism showered upon General Grant was so bitter that President Lincoln was urged to remove him from his command. Fortunately the President stood loyally by his general, with the result that the blunder of Shiloh was soon redeemed by the success at Vicksburg.

OARS, SAILS, *and* STEAM— *The* CONQUEST *of the* SEA

How the Ship Which Discovered America Compares with a Modern Liner

UNTOLD thousands of ships, plying across the seas for thousands of years, have woven the countries of the world together in an intricate web. From the lotus-tai'ed Egyptian galleys, and the gay-sailed craft of the Phoenician mariners—

Their hulls were heightened, their sails spread out,
they grew with the growth of their quest;
They opened the secret doors of the East,
and the golden gates of the West,
And many a city of high renown
was proud of a ship on its crest.

From these ancient beginnings down to the proud steel leviathans of today, ships have disseminated knowledge, multiplied wealth, built up national power, and, above all, have slowly wrought a solidarity of human interest.

SHIPS. Picture the *Santa Maria*, Columbus' flagship, lying alongside one of the giant liners of today, say the *Olympic*, which measures about a city block and a half in length—ten times as long as the *Santa Maria*. Passengers and crew, the *Olympic* carries in luxurious comfort more than 3,000 people—about 50 times as many as endured the misery of that first transatlantic passage crammed in the *Santa Maria's* hull. "Great as my respect for Columbus had always been," said a modern naval officer, "it was greatly enhanced when I saw the thing, like half a man's tall-hat case, in which he sailed out into the unknown." The *Santa Maria*, it has been calculated, displaced 200 tons of water. The *Olympic* displaces 60,000 tons—300 times as much. Yet there is an interval of only a little over 400 years between the *Olympic* and the caravels of Columbus, while back of the latter stretches a shipbuilding experience extending over more than 4,000 years.

The Egyptians, early accustomed to water travel by their one great thoroughfare, the Nile, were apparently the first people to construct vessels large enough to deserve the name of ships. Egyptian paintings as early as the middle of the 28th century B.C. show large seagoing vessels propelled by oars (as many as 26 on a side) and sails, and with four or five steering paddles (*see* Transportation). The ancient Cretans (*see* Aegean Civilization) seem to have been the first people to build up an extensive maritime empire, but the first great improvements in ships came from the greatest mariners of ancient times, the Phoenicians, whose merchant vessels were trafficking in distant lands by about 1000 B.C. The Phoenicians constructed galleys with two and three banks of oars, thus gaining speed without increasing the size of the vessels. The Greeks and Romans made these "biremes" and "triremes" formidable engines of war by adding sharp beaks for ramming enemy ships.

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Long before the break-up of the Roman empire, a race of the hardiest seamen the world has ever known, venturing out from the Scandinavian fiords in their narrow shallow one-masted "serpents" and "dragons" with single oar-banks, were preparing to scour the then known world and to enlarge it by discoveries beyond the unknown western seas (*see* Northmen). As the discovery of America and of the route around the Cape of Good Hope drew commerce away from Venice and the other trading cities of the Mediterranean basin, while the introduction of the mariner's compass rendered ocean navigation safer, the new Atlantic sea-powers—Spain, Portugal, the Hansa towns, the Netherlands, and England—developed new types of vessels, such as the caravel and the galleón, rising high out of the water and with lofty "castles" at bow and stern. Sails became ever more important as shipping ventured out upon the Atlantic, though fighting vessels of the Middle Ages continued to rely on oars for propulsion when in action. War galleys attained greater speed by the use of tremendous 50-foot oars, supported by framework standing out at each side of the hull, and each oar pulled by three to seven men. The oared war-galley manned by convicts or prisoners of war survived down to the 17th century.

Sailing vessels of Columbus' time might carry from one to three masts. The rudder, which from ancient days had been a huge oar carried over the right side (whence "starboard," from "steerboard," for the right side of the ship), had long since assumed its more modern form and been placed in the middle of the stern, with a "tiller" or bar handle (later replaced in all but the smallest craft by a wheel) for control. A 1,600-ton ship of 1592 was notable for its size; it was 165 feet long—not quite so large as the Roman grain ships of the 2d century A.D.

AN EARLY LEVIATHAN, THE 'GREAT EASTERN'

The *Great Eastern* (originally called the *Leviathan*), a paddle and screw steamship launched in 1858, was for many years the largest ship in the world. It was nearly 700 feet long, 83 feet broad, and 60 feet deep. It was far in advance of its time, and was never a financial success.

As England grew to be the "mistress of the seas," sails, used more skilfully by English seamen than by their predecessors, became the only motive power for merchant and naval vessels alike. Craft that would be recognized by a modern sailor began to appear on the seas—full-rigged ships in the modern technical sense, brigs, barks, etc. High-water mark in the development of the sailing vessel for beauty and speed was attained, however, not by British vessels, but by the famous "Yankee clippers" of the 1840's and '50's. Previously the hulls of merchant ships had been constructed for capacity rather than speed. The loss and ruin sometimes incurred in the East India and China trade through market changes or deterioration of cargoes on long voyages stimulated the construction of a new type—a long slender vessel, at first small, but later from 135 to over 300 feet long—with fine lines, sharp bows, towering masts, and an immense spread of square-rigged sails, which slid or "clipped" instead of pounding through the water by main force. This was a distinct type from the long, low, rakish, and comparatively small craft —60 to 125 feet long—with full round bows and sails, sometimes square and sometimes schooner-rigged, which had won renown in the War of 1812 as the Chesapeake or Baltimore clipper. The true Yankee clipper rejoiced national pride by making speed records seldom equaled before or since by any sailing vessel; 300 miles a day was not exceptional. During the brief heyday of this craft, the world's carrying trade seemed destined to fall into American hands despite all that alarmed competitors could do. But the fleet beautiful Yankee clipper was merely the romantic closing episode in the long and glorious chapter of the supremacy of sails and wood upon the seas, for the day when steel and steam would rule the oceans was even then dawning.

The United States at present has the largest sailing tonnage (though not the largest number of sailing vessels) of any country in the world, but American sailing vessels are practically all employed in fisheries, in the coasting trade, or on inland waters. All over the world there has been a steady decline in the number of square-rigged sailing vessels as compared with the more economically worked fore-and-aft rigged vessels. The schooner (an American invention)

For any subject not found in its alphabetical place see information

A FULL-RIGGED SHIP

Sailing ships may be divided into three distinct classes—the square-rigged, the fore-and-aft rigged, and the mixed-rigged. The square-rig, which is illustrated above, consists of sails hung from horizontal yards, which are slung at their middle points to the mast. When the ship is sailing before the wind, these sails are spread at right angles or "square" to the keel. A full-rigged ship—a "ship" in the technical sense—has three masts, all square-rigged, called from bow to stern the foremast, the mainmast, and the mizzenmast. A "brig" has only two masts, the fore and main.

A full-rigged ship may carry five or more sails, one above the other, on each mast. The same names are applied to the corresponding sails and spars on each mast, except that the name of the mast is prefixed. In describing the rigging of a ship we shall refer to the foremast, but in every case in which a corresponding spar is used on the main or mizzenmast the number of the corresponding spar will be given, so that you can locate, for example, the fore topmast (6), main topmast (11), and mizzen topmast (16).

Each mast comprises five separate parts or masts. The bottom one is called the foremast (5), mainmast (10), or mizzenmast (15) as the case may be, and the upper ones, in order, are the topmast (6, 11, 16), the topgallant mast (7, 12, 17), the royal mast (8, 13, 18), and the skysail mast (9, 14, 19).

Square-rigged ships usually carry a set of triangular sails called jibs, hung on stays strung from the foremast to a jibboom (2), and to a flying jibboom (1), which project from the bow. Below the jib is a vertical stay called the martingale (4). These jibs serve to "keep the nose up," that is, to keep the sails on the mast from tending to tilt the vessel forward, and thereby drive the bows too heavily into the seas. The bowsprit (3) is the timber which supports the jibboom.

The bottom yards or arms, extending horizontally from the masts are the foreyard (20), the mainyard (27), and the cross jackyard (34). Next above these are the lower topsail yards (21, 28, 35), then the upper topsail yards (22, 29, 36), the lower topgallant yards (23, 30, 37), the upper topgallant yards (24, 31, 38), and the royal yards (25, 32, 39). The topmost yards are the skysail (26, 33, 40). On the mizzenmast are a number of special arms—the spanker boom (43), the spanker gaff (44), and the monkey gaff (45).

The fore-and-aft rig consists of one large sail to the mast. This may be spread between a horizontal boom at the bottom and a shorter gaff above. The gaff is a spar fastened to the mast by a collar; it points midway between horizontal and vertical, and can be raised and lowered by halyards. The sail swings to one side or the other of the mast, or directly back of it ("aft"). Such sails can be handled from the deck, so that a large vessel may be manned by comparatively few men.

The single-masted "fore-and-after," with a gaff mainsail and a jib, is called a "sloop"; with two or more masts, and a jib, a "schooner." A sloop with a smaller second mast is called a "yawl."

Vessels with mixed rigs, the third class, carry both square and fore-and-aft rigging. A two-master with square rigging on the foremast, and fore-and-aft rigging on the main, is a "brigantine." A threemaster with square rigging on the fore, and fore-and-aft rigging on the other two, is a "barkantine"; if only the mizzenmast is rigged fore-and-aft, it is a "bark" or "barque."

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is the typical American sailing craft today. A seven-masted steel schooner built some years ago was nearly 400 feet long, had a capacity of 7,500 tons, and carried a sail spread of nearly an acre—about the same as that of the *Great Republic*, the largest of the clippers, which was about 100 feet shorter and had about half the carrying capacity. A fishing craft or carrier of heavy freights—coal, ore, lumber, etc.—the modern sailing vessel is merely a sturdy drudge with little romantic or esthetic appeal.

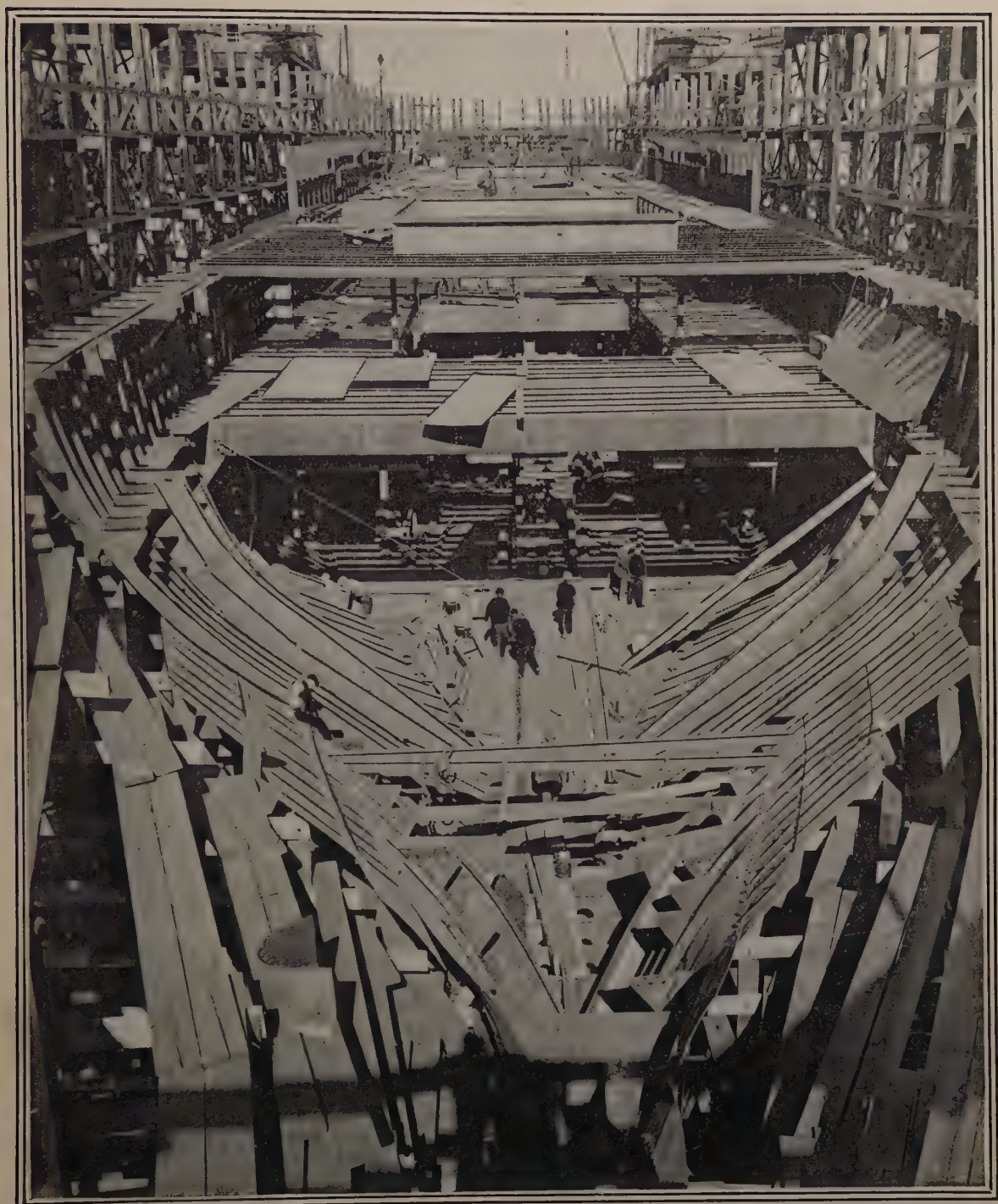
In closing decades of the 18th century many experiments were made with steam propulsion of boats. Twelve years after Fulton's *Clermont* made its first voyage on the Hudson (*see* Fulton, Robert), the first vessel fitted with steam power crossed the Atlantic. This was the American built *Savannah* which in 1819 ran from Savannah to Liverpool in 25 days, most of the time, however, under sail. The engines of those days consumed about four times as much fuel as modern engines for every horse-power produced, so the problem of a transatlantic steam passage was a fuel problem. The *Savannah's* voyage and the one or two transatlantic passages made by steam vessels in following years made such slight impression that in 1835 "sober sensible people" hooted at the suggestion of a steamship line between Great Britain and North America; one might as well talk of running a steamship line to the moon, they said. And a boat from the moon could scarcely have created a greater sensation in 1838 than the arrival in New York harbor of the *Sirius* from London which had made the whole run from Cork in 17 days entirely under steam power. A few days later the *Great Western*, the first steamship built for transatlantic service, arrived from Bristol. And now the transatlantic steam liner was an accomplished fact, and before long the "seven seas" were netted with steamship lines. The only one of the early transatlantic lines to survive, however, was the Cunard line, founded in 1839. The White Star, originally a sailing line, sent its first steamship across the ocean in 1870.

THE MIRACLE CITY, HOG ISLAND SHIPYARD

The Hog Island shipyard at the height of its activities was called the "eighth wonder of the world." From a mud swamp, it was transformed in less than a year into the world's largest shipyard; it boasted one ship launched every 3½ working days, and a total dead weight tonnage of over 600,000 tons launched in a year.

The fastest sailing vessels as a rule made the voyage from Europe to America in several weeks. One sailing vessel made the passage from Liverpool to Baltimore in 14 days 9 hours. Less than a hundred years from the time of the *Savannah's* voyage the fastest steamships were to make it in four and a half days. The first transatlantic steamships, to be sure, were not infrequently beaten in races with the swift sailing packets. Even today, the hourly speed at which it is found most profitable to run ordinary freight steamships—9 to 12 nautical miles—is no greater than that of the clipper ships—12 to 15 miles—and far below the record clipper speed—21 miles. It is only our great luxurious passenger liners, which disdain freight almost altogether, that make speeds of 25, 26, and 27 nautical miles an hour. Yet from the first, commerce tended inevitably to flow in the channels provided by the new steamship lines; and today the London merchant gets tea from China in five weeks, whereas the fastest of the tea-clippers took three months. Steamship voyages are enormously speedier than sailing voyages, even though there may be no such excessive difference in the speed per hour. The overwhelming advantage of steam to commerce is its comparative freedom from delay by adverse weather conditions and its ability to take

BUILDING A SHIP—THE SKELETON



A web of staging, built in movable sections of strong timbers and planks capable of bearing considerable weight, supports the hull until it is ready for launching. After the carpenters have lined up the keel blocks, an erecting gang lays the keel and begins the work of putting in place the steel framework, floors, and steel plating for the outside of the hull. Every part is so marked as to indicate exactly where it is to go. The erecting gang may hang each plate by a bolt or two, leaving it to be adjusted to its exact proper place by a plate-setting gang, which puts in enough bolts to hold it, after which it is solidly riveted by a gang of bolters. As the inner construction proceeds, stagings and supports are built inside the hull and bolted solidly to the frame of the ship. While the principal structural work on the hull is being carried forward, other groups of workmen begin painting the ship inside and out. The entire bottom of the ship and of many of the ballast tanks are covered with a layer of portland cement from an inch to an inch and a half deep. Before the ship is launched its tanks are tested by filling them with water to the height of the load line, and the joints of the decks and bulkheads are tested by a jet of water from a hose at about 30 pounds' pressure. In this case, however, all these processes except the painting come later, for here the construction is just far enough advanced so that the outlines of the ship are becoming apparent. You can see three decks and the framing rising to support a fourth, the cargo hatches, and the first of the plating being put into place.

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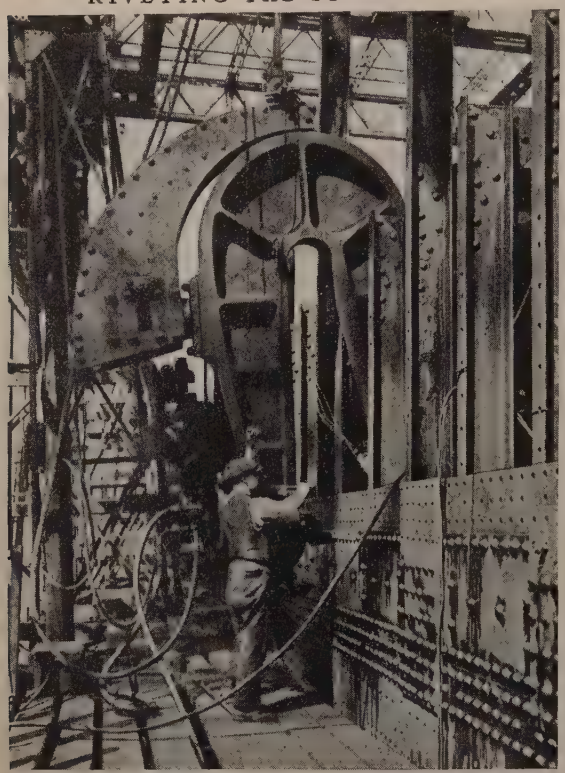
advantage of the shortest routes. A sailing vessel bound from New York to Rio de Janeiro would first sail east almost across the Atlantic to near the Azores,

RIVETING THE STEEL SKIN



The rivets which hold the steel plates together are driven while red hot. Over 650,000 rivets are needed in the construction of an average 10,000-ton ship; it is said that "the history of steel rivets is the history of the steel ship business."

and then turn south, taking advantage of the trade winds to reach Rio; a steamship would be able to take the most direct route.

Almost parallel with the rise of steam power, an equally important revolution in construction was under way. The early steamships were built of wood, but experiments in the use of iron for the hulls of vessels had been made even before the end of the 18th century. Between 1845 and 1880 iron came more and more into general use, gradually superseding wood for large vessels. The Cunard line was still building wooden ships when in 1850 the Inman line of iron screw steamships was inaugurated. The first steel steamboats were built in the 1850's for the exploration of African inland waters. Not until the '70's was steel used for ocean-going vessels, but from 1880 on, steel gradually replaced iron, until today "steamship" practically means "steel ship."

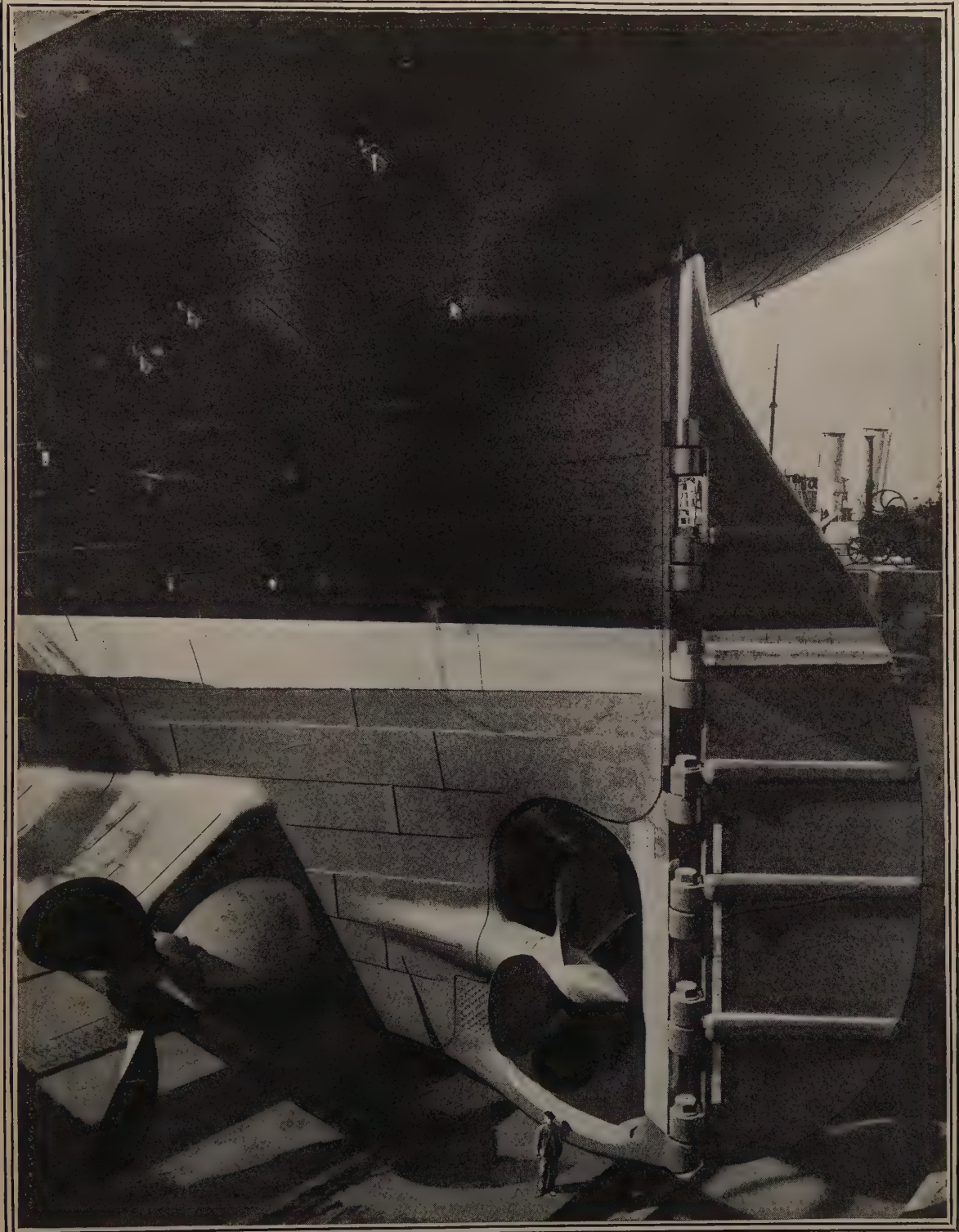
"Will iron float?" jeered passersby at the builder of the first iron vessel. "Pitch your tea cans into the canal and see," he replied. Actually, an iron or steel vessel is not only stronger but lighter than a wooden vessel of the same size, though wood resists a crushing force better than metal, and wooden ships are therefore favored for polar exploration and voyages in polar seas where icebergs and floes are to be feared. Some of the earliest iron vessels built floated scatheless off after buffeting on shoals in storms in which wooden ships quickly went to pieces. Iron construction, it has been estimated, saves 30 to 40 per cent over the weight of wood, and steel saves 15 per cent over the weight of iron. This means increased carrying capacity and lower freight rates. Moreover, steel can be more securely riveted than wood; a large steel ship shows less tendency to sag in the middle or to droop at the ends than a wooden one of the same size. Welding instead of riveting transforms it practically into a piece of solid steel. Therefore the only limit on the size of modern steel ships is virtually the size of the harbors and docks which receive them.

The Decline of American Shipping

Steam and steel ended the fleeting golden age of the American merchant marine. There were other contributory causes for the decay of American shipping, including the disasters it had suffered during the Civil War, the attraction of American capital and labor into new and more profitable fields as the western states were opened up, the opening of the Suez canal, which gave Europe a shorter and cheaper route to the East, and the unequal conditions under which American ships competed with subsidized foreign shipping. But the decisive factor was the advanced state of the British steel industry, which was ready at the time of the revolution in shipbuilding to employ Bessemer's discovery (*see* Iron and Steel) in the construction of ships, while the American steel industry was several decades behind.

The *Clermont* and all later steamboats for many years were propelled by paddle wheels, which are well adapted for the propulsion of light draft boats over smooth shallow waters (some of the early river captains boasted that their boats could run "on a heavy dew"), but are less efficient than the screw propeller in deep waters. An American inventor, Col. John Stevens, had worked out the principles of screw propulsion of steam vessels even before Fulton's memorable first voyage on the Hudson, but American tools and machinists were not then equal to reproducing Stevens' beautiful models. So the first ocean screw steamships were built in England between 1836 and 1839 by an Englishman, F. P. Smith, and a Swede, Capt. John Ericsson, later of *Monitor* fame (*see* Ericsson, John). Paddle wheels would have offered an inviting target to an enemy in war; the advantage of the screw propeller, placed below the water line, quickly appealed to American and British naval authorities. Merchant vessels generally were slower to discard the paddle wheel, chiefly because the marine engines then in use could not economically drive screw propellers. About four years after "Inman's iron screws" were placed in service, the compound engine (*see* Steam Engine)

HOW THE OCEAN GIANT IS PUSHED AND GUIDED



The tiny figure of the man at the bottom of the picture will help you to realize how enormous are the rudder and propellers of a big modern ocean liner. The rudder alone weighs 70 tons—as much as a medium-sized locomotive. As the ship plows its massive way through the waves, the helmsman turns a small wheel high up in the wheel-house; immediately powerful machinery obeys the command and twists the rudder post, swinging the great rudder on its hinges with the smoothness and accuracy of a watch. The three giant propellers, projecting at the ends of their powerful steel shafts, likewise obey the touch of the engineer's hand, threshing the water with their twisted blades to drive the vessel forward or to check it suddenly in its headlong course.

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was adapted to marine use, and the screw propeller quickly became the recognized mode of propulsion for ocean vessels. Twin screws, lessening the danger of accident, came a little later; three and even four screws are used on some steamships today. Later yet came the triple-expansion engine; and this was the last work in marine engineering until the application of the turbine to steamships.

The first turbine steamboat, the *Turbinia*, demonstrated in 1897 the sensational speed capabilities in this mode of propulsion (*see* Turbine). The *Mauretania* today makes a speed of 26 to over 27 nautical miles (30 to over 31 land miles) an hour by means of six great turbines, the blades of which, running at full speed, have a velocity at the outer tip of nearly 10,000 feet or nearly two miles a second. Speed rivalry some time ago led to some disregard of safety; but there is little tendency at present to attempt to outdo speed records.

The Great Devourers of Coal

Speed on the ocean is a costly luxury. The coal burned in one day by a large modern liner, it is said, would drive a tramp steamer of 6,000 tons freight carrying capacity back and forth between New York and Liverpool three or four times, running at a speed of nine or ten miles an hour. It takes about 6,600 tons—about 22 trainloads—of coal to carry the liner across; and this mountain of fuel, with the machinery in which it is burned, is so bulky that the monster vessel has room for only about 1,500 tons of freight. The cost and bulk of the fuel required for high speed forbid the freight steamship to exceed the limits dictated by freight rates, while the less expensive passenger liners make no attempt at speed records. Thus one steamer consumes 316 tons of coal a day to make a speed of 19 knots; another nearly two and a half times as large consumes only 260 tons a day for a speed of 16½ knots.

Great savings in labor and space have been made by equipping steamships to burn oil, the fuel destined, it is said, to supplant coal in ocean navigation. Formerly, 140 men needed three or four days to coal the *Olympic* for a voyage. Now that ship is equipped as an oil-burner, saving 1,000 tons of cargo space, and seven men pipe the oil into the tanks in six hours. A hundred and fifty firemen, who formerly sweltered in an inferno while they slaved to fill the greedy maws of the red-hot furnaces, are released; no such toil is needed in tending the oil furnaces. The entire annual money saving is estimated at nearly $1,300,000. To war vessels the great advantage of oil fuel is that it enormously extends the length of the voyage which they may take away from their base of fuel supplies and makes it possible to take on fuel at sea through pipe lines from tank ships (*see* Navy).

Great "floating palaces" like the *Olympic* and the *Mauretania* may have from 7 to 10 decks, electric elevators, open-air gymnasiums, swimming pools, libraries, music rooms, lounges or drawing rooms, smoking rooms, and private suites of rooms like miniature flats, with electric heat, silver fittings, silk hangings, etc.—all the luxurious magnificence, in short, of the most expensive metropolitan hotels. The majority of passenger ships, however, are of an intermediate type, which provides every comfort for the passenger without costly splendor.

In the shipyards that dotted the North Atlantic coast until after the Civil War, wooden ships were built at first—during the colonial period—on the "cut and try" plan, after the pattern of some former ship. Gradually American shipbuilders mastered the use of drawing instruments and the theory of vessel designing, and soon it was the original design of the ships constructed in the American shipyards, even more than the excellence of American live oak, white oak, yellow pine, and spruce, which gave preëminence to American vessels.

It was altogether a native industry. The boys that loitered in the shipyards after school probably looked forward to sailing in just such a ship as that now growing to the merry tune of clattering mallets and scraping saws wielded by workmen who were friends and neighbors—perhaps themselves retired sailors. The owner's daughter might pose as a model for the figurehead shaped by the wood-cutter in the corner of the yard. Most of the workmen were artists in their way, taking pride in the work of their hands and competing jealously for the more difficult tasks. Until about 1830 any skilled shipyard mechanic performed any and all work incident to the construction of a ship. Thus the industry was itself a school for all engaged in it.

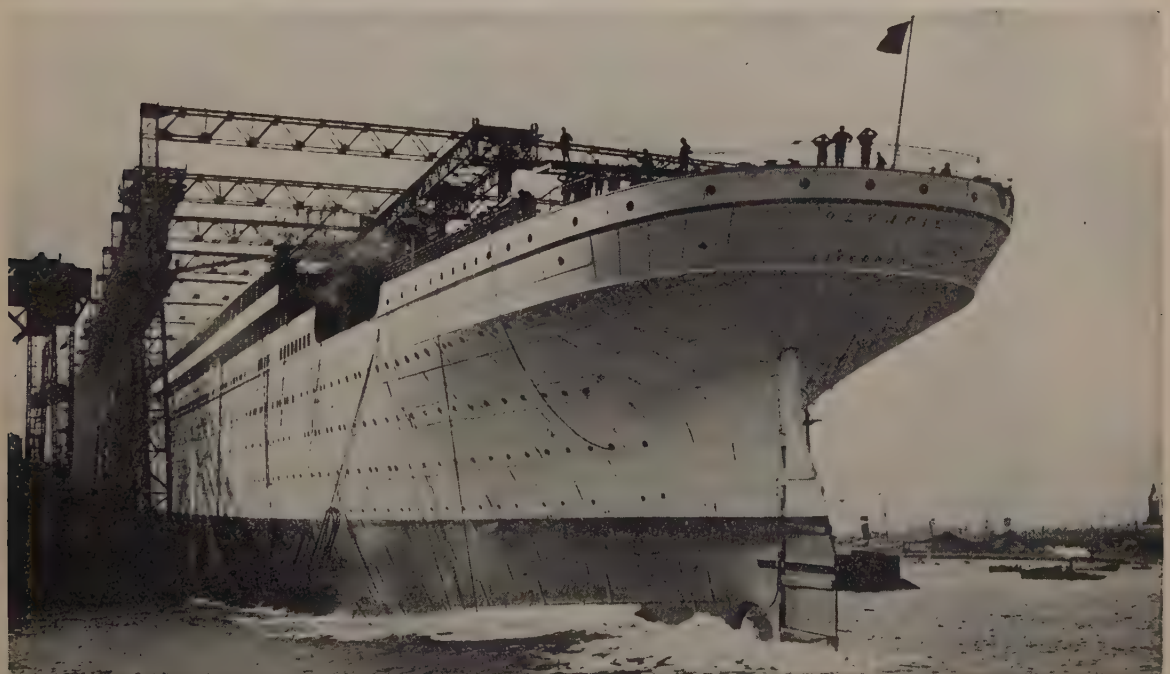
Modern Shipbuilding

The difference between that time and today can best be appreciated by a glance at a modern shipyard. Let us visit the greatest shipyard ever known, the huge Hog Island plant, at the height of its activities during the World War when the cry was ever for ships and more ships to bridge the ocean and outstrip the destruction of the German submarine. Hog Island, near Philadelphia, was a mud swamp of over 900 acres, which in less than a year from September 1917 was transformed into the world's largest shipyard, with a modern city for housing employees and 75 miles of railroad connecting all parts of the plant with the fifty shipways. This one yard had a record of one ship launched every three and a half days, a total of over 600,000 tons of shipping launched in a year.

As we approach, our ears are assailed by the gigantic clamor of crashing metal, from which presently we are able to pick out individual notes—roaring foundries, clanging engines, whirring dynamos, and thundering hydraulic hammers. At the water's edge, the cranes and scaffolding of the ways form a rough pattern of upstanding colossal lace-work. Underfoot instead of the springy carpet of spicy chips and shavings covering the ground in the wooden shipyard, we find a strange litter of monstrous metal parts among which we pick our way—steel plates and bars,

THE GREAT MOMENT THAT TESTS THE SHIP

Here we see a ship leaving the "ways" in the shipyard at Pensacola, Fla., while an excited crowd leans over the railings above to wish the new vessel good luck. Ships may be launched sideways, as here, or stern foremost, depending upon the convenience of the shipyard.



And here is the great *Olympic* calmly and quietly entering the water. As a vessel nears completion, launching ways are prepared. The ground or fixed ways, built along the keel, support on their planed and greased upper surfaces the sliding ways which are to carry the vessel into the water. At the moment of launching, wedges are driven between the movable ways and the hull so that the keel blocks can be knocked out; the weight of the ship then rests on the ways, and as soon as the planks which hold it in place are sawed off it glides down into the water.

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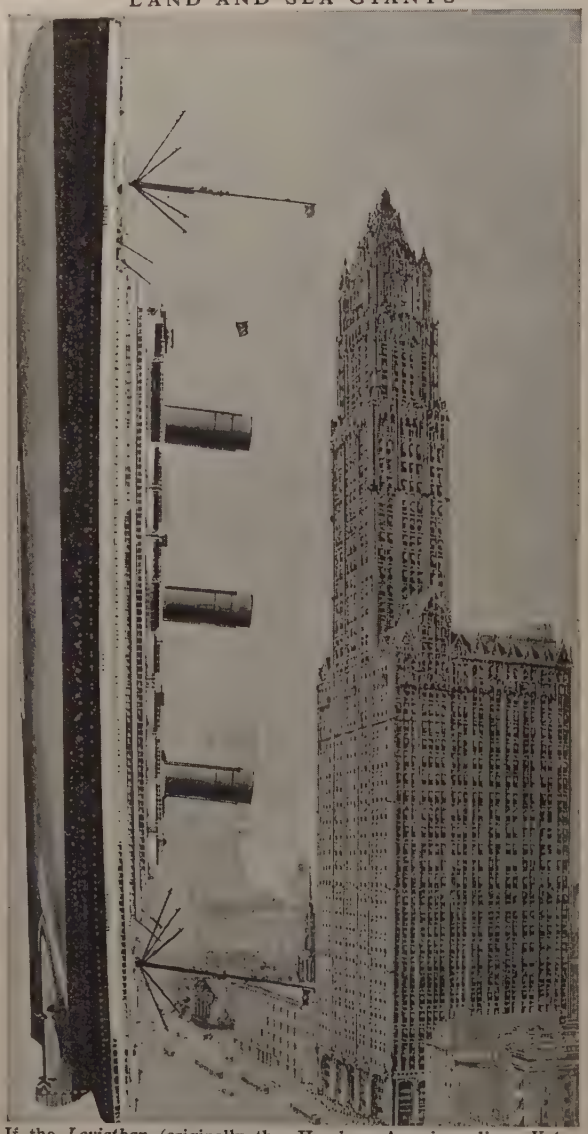
iron chains, etc. As various and, to many of us, as unfamiliar are the tasks of many of the men we see at work in the open air or in the vast interiors of the sheds and mills—furnacemen, rollers and flangers, punchers, shearers, acetylene cutters, electric welders, machine riveters, chippers, calkers, yard riggers, besides clerks, draftsmen, electricians, carpenters, machinists, painters, and unskilled laborers, employed on various specialized tasks. When the whistle blows and the 5,000 and more employees of the yard surge forth for the mid-day meal, we see as motley a mingling of races and nationalities—not only Americans, Englishmen, and Irishmen, but Scandinavians, Greeks, Portuguese, Italians, Slavs, and negroes. Most of them know as little about the ships on which they are engaged today as they did about the bridges, the sky-scrapers, or the roads on which they were employed a few days or weeks ago.

In normal times, such data as tonnage requirements, speed desired, and depth of water in the harbors which the ship is intended to frequent are given to the designer of the ship to be constructed. He first calculates the displacement and then determines length, beam, and depth. In accordance with these data he prepares his design, which is turned over to structural and engineering draftsmen to work out in detail. During the war standardized designs were largely used, instead of having a marine architect work out an individual design for each vessel. This saved time, just as it saves time for a dressmaker or tailor to use a standardized design or pattern for clothes instead of designing each individual garment separately.

The drawings or blue prints of the design, made to scale, are re-drawn full size on the floor of the mold loft. This room (usually the top floor of the largest building in the yard and 100 feet wide and several hundred feet long—large enough to take in the full-size plan of a liner or battleship) has a specially prepared floor, as smooth as a school blackboard. From the drawings on the mold-loft floor, full-size wooden or paper patterns, called "templates," are constructed for each piece of steel to enter into the vessel. On each template every rivet hole, bend, flange, or angle line is accurately indicated. The ship-fitter transfers these marks to the steel plate, which is then taken to the steel mill to be cut, bent, punched, and shaped in accordance with the indications of the template.

LAND AND SEA GIANTS



If the *Leviathan* (originally the Hamburg-American liner *Vaterland*), were turned on end beside the Woolworth Building in New York City—the tallest building in the world—the bow of the ship would tower high above the skyscraper.

Even this labor was to a great extent eliminated in the construction of fabricated ships such as those built at Hog Island. They represented the supreme effort to speed up steel ship construction. In the rigorously simple design of the fabricated ship—mainly tankers and certain kinds of freighters—every unnecessary curve—every non-essential of whatever kind—was suppressed, and the parts, so far as possible, were turned out in quantity, shaped, punched, and prepared for use, instead of being prepared in accordance with specifications as needed, just as the parts of ready-made garments are cut and prepared by thousands. The fabricated ship, in fact, was a "ready-made" as contrasted with a "made-to-order" ship, and this enabled the Hog Island plant to turn out, as from a factory, the largest ship tonnage ever built within a given time.

The actual construction of the ship begins with the laying of the keel. First, the berth for the ship is prepared at the water's edge. Keel blocks—short heavy timbers with the upper surface shaped to the

A STREET ON A FLOATING CITY

If you could pick up a city street and set it down on the decks of the 'Aquitania', the traffic could go on unhindered and the great liner's smokestacks would project well above many an office building.

keel line—are set up with a very slight incline toward the water. On this is laid the keel, composed of a number of bars or thick plates of heavy steel, each perhaps 40 or 50 feet long, riveted together to make the desired length and thickness. While the frames are being built up from the keel and the plates are being riveted in place, temporary staging is erected inside and outside the hull as needed.

The steel plates which form the shell of the ship are laid, like giant fish scales, 20 to 40 feet long, in overlapping horizontal rows called "strakes." They provide the main strength of the hull, being merely supplemented by the frames. The seams of wooden ships are calked with oakum and pitch; steel ships are calked by driving down the overlapping edges of the upper plates so that they "bite" the plates below. In some of the latest vessels they are electrically welded instead of riveted, producing practically a solid metal shell.

Large steamships are built today with double bottoms, which lessen danger in case of accident. The space between the bottoms, in which a man can almost stand upright at the center of the hull, is used for ballast or for storing fresh water for the boilers or oil for the engines. Still more important for safety are the bulkheads or crosswise and lengthwise vertical partitions which divide the hull into watertight compartments. The more numerous these compartments, provided they are really watertight, the less the danger of sinking. The main lengthwise bulkhead is of special value also in counteracting the tendency of the ship to sag in the middle or to "hog," as drooping at the ends is called. Of particular importance is the "collision bulkhead" in the bow, which is built especially strong to withstand ramming and to confine the damage to that part of the ship if the bow should be stove in. The doors in the bulkheads are watertight and provided with closing apparatus electrically controlled from several central stations, so that any or all can be closed in a second by pushing a button.

The hull is usually launched as soon as it will float; construction and fitting are finished in the water. The launching must be as carefully planned as

the construction, for irretrievable injury has occurred from accidents at launchings. A vessel is usually launched stern foremost; occasionally, where water space is narrow, side foremost.

Even standardization and fabrication of steel ships did not alone completely meet the need for speed in shipbuilding during the war. The wooden shipbuilding industry was revived. New materials were pressed into service. Ships were built, like bridges, reservoirs, and large buildings, of reinforced concrete; that is, concrete poured into a mold around a steel frame. The seaworthiness of such a craft was demonstrated by the 5,000-ton concrete freighter *Faith* launched at San Francisco in 1918. Such a ship, it is said, cost about a fifth as much as a steel freighter of the same size, and could be built in about half or a third the time. The concrete ship division of the Federal Shipping Board developed a concrete which is one-fifth lighter than wood and therefore floats on water. The porous quality of concrete was originally its main drawback as a ship material, but the division produced a protective waterproof coating which was expected to make concrete ships as durable as wood, if not more so, in view of the fact that the marine wood-borer cannot attack concrete.

Varieties of Modern Ships

Varied demands have produced an almost infinite variety of ship types. Omitting war vessels (*see* Navy; Submarine), ships may be roughly classed according to use as: (1) luxurious ships almost exclusively for passenger service; (2) ships carrying both passengers and freight; (3) freight ships.

The first class includes the largest as well as the most luxurious and the swiftest vessels built. This is a matter of commercial necessity; the immense cost of high speed can be met only by large steamers devoted to the most expensive passenger service. The Cunarder *Mauretania* is about a city block and a half long; one of its funnels, turned down, could take in two lines of subway cars side by side. Yet the *Mauretania*, with its 32,000 gross tons and its length of 790 feet, does not bulk large by the side of its big sister the *Aquitania* (47,000 gross tons; length 901 feet), of the largest White Star liners, the *Olympic* (over 46,000 gross tons; length about 880 feet) and the *Britannic* (50,000 gross tons; length 900 feet); while it is fairly dwarfed by the monsters built for the Hamburg-American line, the *Imperator* (51,000 gross tons; length 909 feet), the *Vaterland* (54,000 gross tons; length 950 feet), and the *Bismarck* (about 58,000 gross tons; length 955 feet). The *Vaterland* was one of the German vessels interned by the United States at the outbreak of the World War; it was seized when the United States entered the war and operated as the transport *Leviathan*. The *Imperator* was turned over to the British at the armistice in 1918 and was put into the service of the Cunard line, and the *Bismarck*, which had not yet been completed, was given to the White Star line, also a British company.

Of the vessels in the second class, some are devoted about equally to freight and passenger traffic, while others derive most of their revenue from a single branch, carrying freight or passengers as a side line. Transatlantic emigrant vessels are always arranged to carry as much cargo as possible. The holds of some of these vessels carrying perishable produce, such as the ships bringing meat from Argentina and New Zealand and fruit from the tropics, are fitted up as great refrigerators. One such vessel of 7,500 tons carries over 500 passengers in comfortable quarters; its insulated cargo-holds are chilled by 20 miles of brine pipes.

In the third class are included freight liners, which keep to a definite course and schedule like passenger liners; tramps, which ply all over the world, wherever they can pick up a cargo (*see* Commerce), and vessels built and operated to take care of certain classes of traffic, like the oil tank steamers, the iron ore and grain steamers of the Great Lakes, and the lake and ocean steam colliers or coal-ships. Some of the hugest and most wonderful freight-handling devices in the world are used in connection with these Great Lakes freighters (*see* Great Lakes). Built like great boxes, with flat bottoms and straight sides, and with pilot house and officers' quarters forward and crew's quarters and machinery aft, the vessels are unobstructed amidships. A boat 600 feet or more long will have about 12 great hatches, each nearly as wide as the craft, through which 12,000 tons of ore can be delivered by gravity chutes in two hours, and unloaded in eight or ten hours by huge clam-shell grabs, each lifting 5 to 15 tons at a time.

Then there are vessels for special uses, scarcely to be classified as either freighters or passenger ships. Such are dredgers, tugs, cable-laying ships, ice-breakers, surveying, salvage, and coastguard vessels, and train-carrying ferryboats. Of the last-named class, some have been built carrying four tracks, and capable of transporting two locomotives and 24 to 36 cars. Some train ferryboats operating on the Great Lakes and in similar situations have been built to operate also as ice-breakers.

Paddle Wheels and Screws

Again, since hull and engine must be adapted not only to use but to the waters where they are to operate, vessels may be classified as ocean-going, coastwise, lake, and river craft. Paddle wheels, by which a boat may be safely manoeuvred in limited space, are still preferred for river vessels; they are also much used for lake passenger boats. Double screws—not twin screws side by side but a screw at each end, permitting rapid reversal—have come into general use for ferry boats. The "whaleback" type of vessel, with its rounded deck over which waves can sweep without injury, has been used both on the Great Lakes and on the deep sea; as a lake cargo boat it has been superseded by the straight-sided barge type just described, because of the advantage in rapid unloading possessed by the latter.

WHY THEY ARE CALLED "FLOATING PALACES"

If some genie out of the 'Arabian Nights' suddenly whisked you into this great salon lined with plumy fronded palm trees and banked with flowers, could you guess yourself afloat in midocean? Such luxuries are typical of the great liners of today.

The absolute dependence of the civilized world on shipping was emphasized as never before during the World War. If the submarine campaign of the Central Powers had succeeded, Great Britain would have suffered actual starvation. As it was, the destruction of the merchant-shipping, which is such a large and unappreciated fact in everyone's daily life, meant some degree of privation or change of habits for people almost everywhere.

At the outbreak of the World War, Great Britain had between three and four times the tonnage of its nearest competitor, Germany. By counting in lake, river, coast, and deep-sea vessels, American tonnage came next after Germany, but nine-tenths of American ocean trade was carried by foreign vessels. The ruthless German submarine campaign, necessitating a "bridge of ships" to carry food and troops across the 3,000-mile ocean barrier between the United States and Europe, also effected a redistribution of tonnage to a considerable extent. At the end of the war Great Britain and the United States owned approximately 60 per cent of the world's tonnage. Of the 57,000,000 tons of shipping, 20,000,000 were British, 16,000,000 American, about 3,000,000 each French and Japanese, about 2,000,000 each Italian, Norwegian, and Dutch, and about 1,000,000 each Swedish and Spanish, the rest being distributed in smaller numbers among the many other nationalities of the world.

Feudal conditions were the invariable lot of the seaman on shipboard in the past. For the length of the voyage he was bound to the ship as the medieval serf was bound to the land. The ship's officers had over him, while on board, all power short of life and death; and punishment which indirectly resulted in death might be inflicted with impunity. No matter what the conditions and treatment on the ship, the sailor was subject to arrest and punishment for desertion if he left it in any harbor before the end of the voyage for which he had signed.

Such conditions are still the rule in the merchant marine of some nations. For American shipping they have been ended by the Seamen's Act of 1915, which abolishes arrest and imprisonment for desertion, prohibits flogging and all forms of corporal punishment, and regulates the payment, duties, treatment, and discharge of seamen. The act provides that no vessels of 100 tons and upwards, no matter what their nationality, may leave any port of the United States unless 75 per cent of the crew can understand the orders of the officers. The law requires that crews' quarters be large enough to provide 16 square

feet of deck and 120 cubic feet of air for each individual, setting a good standard of sanitation and comfort. It provides also for medical attention, and for a good quality of food.

A ship's size and capacity are expressed in terms which are somewhat confusing unless certain distinctions are kept clearly in mind. "Displacement" or "displacement tonnage" is the weight of the water which the ship displaces —in other words, the weight of the ship itself. "Dead weight tonnage" is a ship's maximum carrying capacity, or the difference between its displacement light and its displacement loaded to its limit. Passenger and freight liners are seldom or never loaded to the limit of their capacity, and the term is not used in connection with them, but chiefly as a basis for charges on tramp steamers chartered to carry heavy commodities. "Gross tonnage" is defined as a ship's total measured cubic contents (in actual practice certain spaces are excluded from measurement in ascertaining gross tonnage) in "tons" of 100 cubic feet each. The official United States mercantile marine statistics are estimated on the basis of gross tonnage. "Net tonnage" is what remains of gross tonnage after deduction of space for fuel, machinery, crew's and officers' quarters, and other spaces devoted to purposes necessary for operation of the vessel. It is sometimes estimated that net tonnage averages about two-thirds of gross tonnage, but the ratio between gross and net tonnage varies widely in individual vessels; net tonnage may be very insignificant in an "ocean greyhound." The basis for tonnage dues is net tonnage, which is necessarily calculated according to arbitrary rules. There is a story of a man who, feeling injured at the tonnage dues on his vessel, built one in which the net tonnage, calculated according to the established rules, was a minus quantity, and who accordingly maintained that the harbor authorities owed him money whenever he left port.

FOOTWEAR—*From the* ANCIENT SANDAL *to the* MODERN SHOE

An Early 15th Century Shoe, with Stirrup and Spur

SHOES. Man is the "tenderfoot" among animals, so in very ancient times he began to fashion some sort of foot covering for protection from the burning sands and the stony ground. The animals could leave all this to nature, for they were provided either with soft cushions like those on the feet of the cat or with horny hoofs like those of the horse.

Man's earliest footwear was the sandal. Mats of woven grass, strips of hide, or flat pieces of wood to protect the soles of the feet were fastened by thongs over the foot, or sometimes brought up between the toes and bound around the ankle. In time, more material was added to cover the foot, either for decoration or for protection from the cold, and the sandal became the shoe. The Greeks and the Romans worked out a variety of decorative sandals, and some of the Roman styles approached the shoe form. In colder regions some of the first shoes were mere bags padded with grass and tied about the feet. Sometimes the skins of animals were made into moccasins or clumsy boots.

Sandals are still worn by a great many of the people of the Orient, and moccasins and soft skin boots are today made and worn by Indians and Eskimos. Another odd shoe still in use is the wooden shoe cut out of a solid piece of wood, worn by the peasant in Holland and other parts of Europe. The "clog" shoes worn by some of the millworkers of England and elsewhere have wooden or metal soles.

Modern footwear had its beginning in the Middle Ages. In the feudal days, the craftsmen who fashioned the footwear for the castle lords and ladies were very important personages. Substantial footwear was necessary in the cold northern climates, and persons who took part in the Crusades or went on long pilgrimages needed durable shoes. Furthermore the barons and knights paid a great deal of attention to their appearance, and to please them their craftsmen showed great individuality in working out a variety of slippers, shoes, and boots. Some were made with and some without heels. Some were adorned with great buckles. Fashions ran to ridiculous extremes. In the 13th and 14th centuries it was fashionable to wear long narrow-toed shoes; the higher the rank of the wearer, the longer the toes. When the toes grew to excessive lengths they were looped up and tied at the knees. Such shoes were cumbersome and awkward and were also very wasteful of material, so laws finally put an end to the style by threatening to fine and punish the wearers. High leather boots were fashioned as a protection to the leg after the knights ceased to wear full armor, and the height of the boot and the manner of its adornment came to indicate the importance of the wearer.

For any subject not found in its alphabetical place see information

In all this rivalry of shape and fashion very little was done to make the shoe comfortable or to shape it to the foot. A boot or shoe would fit either foot, and it was not until about 1785 that in England a "right" and "left" last was used. More recently a great deal of study has been given the problem of securing the greatest foot comfort. This is especially true of army shoes, for it is very important that marching shoes for the soldiers be correctly built so as not to cramp or blister the feet on long marches. The later development in the industry has been chiefly in making shoes which are both comfortable and attractive, and in turning them out in such quantities that the price may be lowered.

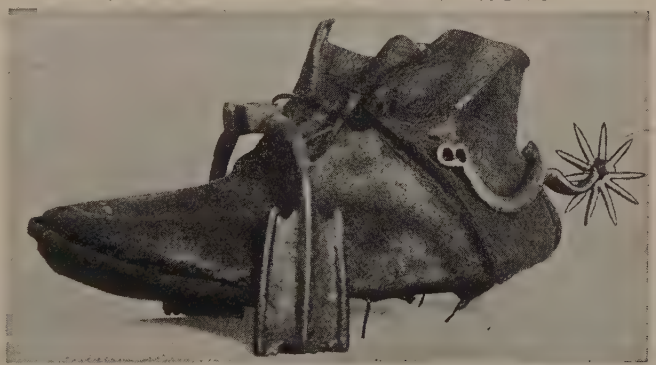
SANDALED FEET OF THE ROMAN

These two Roman sandals, that once trod London streets in the days when Rome ruled the world, were dug up in a deposit of peat in the Moorgate district of London.

Shoemaking as a business was introduced into America in 1629, when Thomas Beard, a shoemaker, arrived under contract to make shoes for the Pilgrim colony. In the pioneer days shoes were valued for their warmth and durability rather than for their style; but the trade soon developed so that the American shoes were said to compare favorably with those of the old country.

A young man desiring to learn the trade in those days would apprentice himself to a shoemaker. After he had learned the trade and had served his apprenticeship, he would become a journeyman. For a time he might go about from one family to another and from one town to another carrying his crude tools with him. Later he would settle down in business for himself as a shoemaker and cobbler or would become a hired workman in a large shoemaker's shop.

A RELIC OF THE MIDDLE AGES



Here is another shoe that walked the earth many centuries ago. It is a shoe of the Middle Ages and was found with the iron stirrup and spur in digging a ditch in the Newgate district of London.

At first one man did all the work on a pair of shoes. Later shoemakers with a reputation for making especially good shoes found that they could profitably employ others to do certain parts of the work for them, and one man would give all his time to cutting out and stitching uppers, another to putting on soles, and so on.

This was the beginning of the "factory system" in the shoe industry. After the invention of the sewing machine, machinery began to take the place of the expert hand work—a change which occurred also in many other industries with the coming of the factory system. In a modern shoe factory today there are as many as 170 distinct processes, taken care of by as many different machines. Many of these machines are very complicated and are so wonderfully adapted to their particular task that they seem to have more than human skill. Machinery makes a uniform product at a greatly increased rate of output. By expert hand work it was possible to turn out one pair of shoes a day for each man employed. With machinery it is now possible to make a pair of shoes in a quarter of an hour, and the output may be as large as ten shoes a day for each workman.

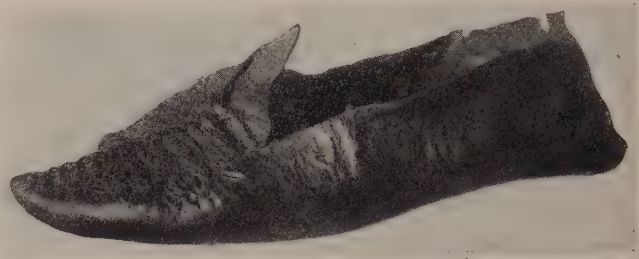
The United States led in the invention of machinery for the shoe industry, and that is why it is a leader in the industry today. Since 1870 its importation of shoes has been almost negligible, while the products of its shoe factories are sold in every country of the world. Over 300 million pairs of boots, shoes, and slippers are turned out in a single year.

The introduction of machinery began in the early half of the 19th century. The early shoemaker put the leather over a lapstone and pounded it with a hammer to make it smoother and more durable. A "roller" machine to roll and press the leather was one of the first machines to come into general use. In hand work the pattern for the parts of the shoe was laid out on the leather and the pieces were cut out with a sharp knife, one by one. Now dies are operated by machine, stamping out a number of pieces at one stroke and with absolutely true edges. The cloth linings also are cut on similar machines.

The invention of the sewing machine marked an epoch in the manufacture of shoes. Special machines were first adapted to sewing the seams in the linings and uppers, and in some factories there is even a specially built machine to sew each different seam. The final triumph of the sewing machine came when it was adapted to the difficult work of sewing the upper to the thick heavy sole.

When the specifications for an order of shoes are received in a modern factory, copies are made and sent to the different departments. Starting in the stock room, leather of the proper grade and quantity is selected. Uppers are cut from light cattle hides, calf skins, sheep skins, goat and kid skins, and horsehides, while the soles are made from cow hide. (For the making of leather *see* Leather.) The leather is put through a "rolling" machine and then through a "stripping" machine, which makes it of uniform thickness. Then it is sent to the cutting room, where the "clicking" machines stamp out the required number of parts by means of dies made up for this particular order. A "skiving" machine trims down the edges of the pieces to a neat beveled edge, and another machine folds over and pounds down any edge that will show on the outside of the shoe.

A SHOE OF SAXON DAYS



Shoes like this were worn by the ancient Saxons. They were simply pieces of leather shaped around the foot like the moccasin of the Indian.

The uppers with their linings are sent to the sewing room. Here they pass down the line of machines, each operator sewing one kind of seam, until the uppers are lined and ready for the sole. The metal eyelets are then stamped in for the laced shoe, or the buttons and button holes provided for the button shoe—machines doing the work in either case.

Meanwhile, the soles are cut, put through a "splitting" machine, and pressed, coming out with uniform thickness, smooth finish, and shaped to the sole of the foot.

Why the "Last" Comes First

The shoe is put together on a last, which is a wooden foot of the size and shape that the shoe is planned to fit. Workmen put the upper on the last, with the toe and heel stiffening in place, and little more is required to be done by hand. Thereafter, practically all that the workmen do is to pass the shoe from one machine to another.

Some of the most important machines are used in these remaining stages of the work. The "lacing" machine quickly laces the upper together to hold the sides in proper relation to each other. On the "pulling-over" machine iron fingers grip the upper and the lining, and pull them down evenly over the last where they are held by two tacks. The "lasting" machine smooths out all the wrinkles in the upper and tacks it in place. Then comes the most important machine of all, that which sews the upper to the sole.

The earlier machines for attaching sole and uppers were machines to nail or tack them together, but the nails wore through the insole and pressed into the foot. Wooden pegs were substituted for the metal nails, but there were still complaints. Today the soles are sewed to the uppers with the McKay stitching machine or the Goodyear welt-sewing machine. The Goodyear machine is considered the best of all, for the stitching leaves the inside of the sole perfectly smooth. In the Goodyear method the insole is fastened to the bottom of the last. The upper is then drawn over, with its edges reaching around to the edges of the insole. A narrow strip called the "welt" is fastened below these, and the outer sole is then sewed to the welt.

The shoe is now ready for heeling and this is done on the "lightning heeling-machine," so called from the speed with which it works. The heels are built up of different lifts of leather, cemented together, and put under pressure to make them durable and shapely. After the heels are put on, a "slugging" machine drives metal pieces or "slugs" into the bottom of the heel, at the places where most of the wear comes. Then machines grind the heel and the surface is smoothed with sandpaper and buffing machines.

The shoes with the soles and heels attached are then sent into the finishing room. There the soles are smoothed and polished; the uppers, sides of the heels, and the edges of the soles are blackened and polished; the trademark of the manufacturer is stamped on the sole—and the shoes are ready for market.

The Hand of Monopoly in the Shoe Business

The manufacture of shoes in a modern factory is practically dependent upon the wonderful machines we have been describing, all of which have been patented in recent years. A manufacturer cannot hope to compete in the shoe industry today if he cannot secure the use of these machines for his factory. With the introduction of the McKay sewing machine, some 50 years ago, the practice of *leasing* the machines grew up and this practice is now followed by the makers of practically all the shoe-making machines. Under this system the manufacturer cannot buy the machines which are essential in the shoe factory, but must operate them under a license or leasing agreement which provides for the payment to the owners of the patents of a royalty on the output of his factory. The amount of the royalties on these machines rises to enormous sums. Patents on many of the very important machines are in the hands of a few men and the absolute control of these machines puts great monopolistic powers in their hands. The right to continue this licensing system has been contested in the courts but the system was declared legal, so it will probably continue, until the period for which the patents are granted expires.

For any subject not found in its alphabetical place see information

THE EARLY STEPS OF A SHOE

These hides for soles
This cloth for linings
These hides for uppers
This heavy machine stamps out the soles
Here the lining patterns are cut out in bunches
This machine stamps out the different parts of the uppers
The edge of each piece is beveled off so that the seams won't be heavy
and here the many holes are punched in the tips
Then the upper and lining are sewed together
The sole is now sewed to the upper
The upper is tacked to the last, trimmed and filled with a cork preparation
The lined upper is then stretched over a last
When this powerful machine nails on the heel the shoe is finished
The last is taken out and after inspection
-the shoe is neatly wrapped and packed for shipment

In the first three chapters of this picture story, you see the materials out of which shoes are made in the factory and then, by following the arrows, you can see how, step by step, the shoe walks into being, as it were, and finally goes into the box where you first meet it in the shoe store.

contained in the Easy Reference Fact-Index at the end of this work

SHORTHAND. A very rapid writer of longhand can write only about 60 words a minute—a rate wholly inadequate for keeping pace with speech. By the use of shorthand, however, one who has just mastered the art can usually write 100 words a minute, and expert shorthand writers have made records of more than 250 words a minute. The average public speaker, it has been estimated, speaks at the rate of only 120 to 150 words a minute, and usually a business man in dictating his correspondence speaks slowly enough so that even a beginner who has carefully mastered every step in learning shorthand can keep pace with him.

Forms of shorthand have been in use since very early times—just how early we do not know, but we do know that the orations of Cicero were taken down in some sort of shorthand by his secretary, a Greek slave. England is the birthplace of modern shorthand. From the 16th century on, various systems originated there, but it was not until Isaac Pitman in 1837 published the first work of "phonography," or writing by sound, that shorthand became a practical art. Of the several systems which are in general use today, all but one are "Pitmanic," or systems based on that of Isaac Pitman. The exception is Gregg shorthand, a system which rivals the Pitmanic systems in popularity. It was invented by John Robert Gregg and was first published in England in 1888.

Modern shorthand uses as few strokes as possible to a word, the average number in the practical systems of today being from two to three. The shorthand alphabet includes distinct characters for the representation of consonants, vowels, and diphthongs. Various methods of abbreviation are used, such as writing the most suggestive part of a word instead of the complete outline; using "word-signs," often consisting of a single stroke, for a large number of common words; and using short methods of writing prefixes and suffixes, such as *con*, *inter*, *tion* (*shun*), etc. Another expedient for gaining speed is "phrasing," or uniting two or more words in one outline.

There are certain fundamental differences between the Pitmanic systems and the Gregg. The former use "position writing," an expedient for expressing vowel sounds without writing them; the principal vowel sound in each word is indicated by the position in which the outline is written—whether above, on, or below the line. The Gregg system abolishes position writing by writing the vowel into the word in its regular order, without lifting the pencil; thus it may be legibly written on unlined paper. Another feature of Pitman shorthand is "shading," the heavy writing of an outline giving a meaning different from that of the same outline written lightly. The characters in Gregg shorthand are unshaded.

The consonant alphabet of the Pitmanic systems consists of straight lines and circular curves; that of the Gregg, of straight lines and elliptic curves. Where it is necessary to express vowels in the former systems, dots and dashes are used; and diphthongs are represented by acute angles pointing in various directions. The Gregg system uses what are called connective vowels—circles and hooks joined to the consonants in the order in which they occur in the word represented; and diphthongs are composed of combinations of circles and hooks. This tends to make the system elastic and adaptable.

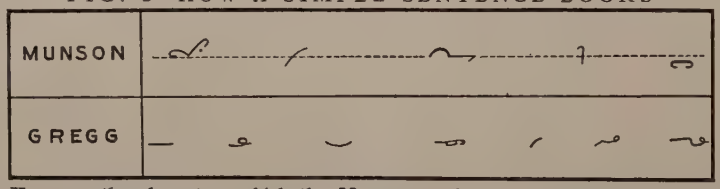
The accompanying table (Fig. 1) shows the consonants in Munson shorthand (one of the Pitmanic systems) and in the Gregg system, respectively. In the Pitmanic systems *l* or *r* is represented at the beginning of a stroke by a small hook, placed on one side to indicate *l* and on the other side to indicate *r*. In the same way *n*, *f*, and *v* are represented by a small hook at the end of a stroke. When position alone might not make a vowel clear, dots and dashes are used. A heavy dot opposite the beginning (top or left) of a stroke is "ah," at the middle "ay," and at

FIG. 1—THE SHORTHAND SYSTEMS COMPARED

	K	G	R	L	N	M	T	D	Th	P	B	F	V	Ch	J	Sh	Zh	S	Z	H	W
MUNSON	—	—	OR				|	|	OR											
GREGG					-	—			OR									OR	OR	•	

The "Munson" system of shorthand, shown above, is a development from the original Pitman method. The Gregg system is comparatively new. By comparing a few of the symbols such as "T," "D," and "W" in the two systems, you can see the differences in character between the methods.

FIG. 2—HOW A SIMPLE SENTENCE LOOKS



Here are the characters which the Munson or the Gregg stenographer sets down in a flash to express, "More rain will make the tree green." You will notice, however, that you cannot read either one by simply comparing the characters with those in the table above. This is because stenographers often use only a letter or two for a word—just as the "Gregg" writer used the letter "m" as a "word-sign" for "more."

the end *ee*. A light dot represents short *a*, *e*, or *i*, a heavy dash *aw*, *oh*, or *ooh*, and a light one short *o*, *uh*, or *oo* as in "good."

Let us write the sentence "More rain will make the tree green" in Munson shorthand. It will look like the upper line in Fig. 2. For the word "more" we have the character for *m* preceded by the hook for *r* and written on the line (called "second position") to give long *o*. For "rain" we have the character for *r*, to which is joined the *n* hook, and the heavy dot in the center of the *r* indicates long *a*. The word "rain" is joined to "more" making a phrase. The word "will" is a word-sign—the letter *l* in third position (cutting the line). For "make" we have the letters *m* and *k* written in second position to indicate long *a*. The little downward stroke joined to the *k* is the word-sign for "the," and here we have another phrase. "Tree" is expressed by the letter *t* to which is joined the *r* hook and which is written in third position to indicate long *e*. For "green" the letter *g* is preceded by the *r* hook, followed by the *n* hook, and written below the line (also third position) to indicate long *e*.

Now let us take the same sentence in Gregg shorthand. It appears as is shown in the second line of Fig. 2. The letter *m* is a word-sign for "more." For "rain" we have *r* followed by the large circle, representing *a* and the character for *n*. "Will," as in the Munson system, is a word-sign composed of the character for *l*. "Make" is easily read, by a glance at the consonant table (Fig. 1), and the next character is the word-sign for "the." "Tree" and "green" should offer no difficulty, the small circle in each word representing the letter *e*.

In the last quarter of the 19th century machines for writing shorthand began to appear on the market. Several of these, such as the stenograph and the stenotype, have proved practicable and are extensively used. They are constructed so that all the keys may be depressed at the same time, and a code has been developed so that a whole word may be written at one stroke. When an operator has memorized the abbreviations he is able to acquire as good speed as by the use of shorthand.

SHRIKE. The "butcher-bird," as the shrike is commonly called, hangs his victims—field-mice, frogs, small birds, lizards, or insects—on thorns or barbed wire, or fastens them in a tree crotch, the better to tear them in pieces. This peculiar habit is due to the fact that the shrike's claws are small and weak, and so he must have some way of holding his food while he tears it into pieces small enough to eat.

Shrikes have few likable traits. They are regular Bluebeards and often kill for the mere love of killing. As a family, they are classified with song birds, but the call note is harsh, and only a few species sing.

These birds are about ten inches long. The plumage, never bright, is generally gray or brown, varied with black and white. The sexes are usually alike. The bulky nest is placed in a tree, usually among thorny twigs or intertwining vines. The white eggs, four to seven in number, are spotted with olive brown.

Shrikes are widely distributed throughout the Northern Hemisphere, and in parts of the African and Indo-Malayan regions. In the Western Hemisphere none are found south of Mexico, and but two species occur in America, the northern shrike and the loggerhead shrike. Of these the loggerhead shrike is the more southern form and the best known. (For illustration in color, *see* Birds.)

Of the Old World species the "great gray shrike" of Europe, pearl gray and white, with black wing and tail feathers, is well known. The small "red-backed shrike" is found in Great Britain. The male of this species has a gray head and neck, rust-red back, and pale rose breast; the female is dull brown.

Scientific name of northern shrike, *Lanius borealis;* of loggerhead shrike, *Lanius ludovicianus*.

SHRIMP. Shrimps, of which there are many varieties, are close relatives of the crawfish, belonging to the class of crustaceans. Their home, however, is in salt water. Shrimps are about two inches long and

A SALT WATER COUSIN OF THE CRAWFISH

A Shrimp, if you meet him canned, looks something like a little pink doughnut. By straightening him out, putting on his shell again, adding a tail and legs and feelers, and returning the natural greenish-gray color to his suit, you have him as he is here and as he looks in his native waters. Fresh shrimps are usually served with their original anatomy but little disturbed, and it's quite a little trick to get them out of their shells, but it is well worth the trouble if you like their delicate flavor.

have tiny paddle-like legs for swimming, long delicate feelers on the head, and a funny little humpbacked, greenish-gray body that ends in a diminutive finlike tail. They play about in pools left by the tide, or bury themselves in the sand, and are easily taken in seines or traps set along the ocean beach. The flavor of their tender flesh makes them a highly prized table delicacy. Canned or dried, shrimps are shipped to all parts of the world. The largest shrimp fisheries are on the north Atlantic coasts of America and Europe, in Louisiana, and in San Francisco Bay.

Prawns are big cousins of the shrimp. They grow to be 5 inches long, in the tropics even reaching a length of 20 inches. They are beautifully tinted in light shades. The flesh, equally esteemed with that of the shrimp, turns a pink color when cooked.

Scientific name of the common shrimp, *Crangon vulgaris;* of the American edible prawn, *Palaemonetes vulgaris*.

The LAND of the SACRED WHITE ELEPHANT

Sacred Elephant in "Swing" Festival Procession, the Siamese Thanksgiving

SIAM (*sī-ăm'*). The sacred white elephant, whose image waved on Siam's red flag until 1918, is still found at times in the trackless mountain forests of that remote land, along with the tiger, the leopard, the wild cat, and the rhinoceros. Monkeys chatter in fear as they flee before monstrous pythons gliding from branch to branch. Peacocks make the somber green depths seem yet more somber in contrast with their vivid plumage. The black-haired brown-skinned natives, their teeth and lips stained red with betel-chewing, still hold to the ways of their forefathers, keeping their dead embalmed in great jars for months before cremation, marrying their boys at 17 and their girls at 14—mature ages as compared with India—dressing in single kiltlike garments hanging from the hips, eating their simple rations of rice and fish with their fingers, and getting their chief delight out of cock-fights and fish-fights.

But the ancient kingdom of Siam, like other countries of the Orient, is fast being transformed by Western influence. Bangkok, the capital, is a cosmopolitan city of the world, and even in many of the remoter regions the natives count the "movie" as one of their favorite diversions. The security of Siam in recent years is due to the fact that it, like Afghanistan, is a "buffer state" between two great European powers—British Burma on the west and French Indo-China on the east. (For map *see* Asia.) For centuries it was hampered by constant wars with native peoples on its loosely defined frontiers; but since 1896, when France and Great Britain guaranteed its independence and neutrality—leaving it the only independent nation of the Indo-Chinese peninsula—Siam has been free to apply itself to internal development.

Under the enlightened rule of its king, who governs as an absolute monarch without a constitution, roads and railways are being built, agriculture fostered, and education advanced. British, French, and American advisers have greatly assisted in improving the various departments of the government. The Siamese are far from an uneducated people, for most of the men can read and write a little in their alphabetized native language, akin to the Chinese—the result of the instruction of foreign missionaries as well as that of the patient Buddhist priests of the innumerable monasteries. But under the new régime all schools are under governmental supervision, and several professional institutions have been established. Many of the brightest graduates are sent every year to complete their studies in the universities of Europe or America.

The surface of Siam (except the narrow strip of Lower Siam, which forms the northern part of the Malay Peninsula) is shaped much like a hand. The fat thumb, to the east, is a low plain of desert scrub and stunted forest, inclosed by hills and the Mekong River. In this plain 2,000,000 people, perhaps the poorest peasantry in the world, eke out a bare living. The fingers are the northern mountain ranges, whose heavily forested slopes, worked by the sturdy hill tribes, produce the major part of the world's supply of teak-wood, as well as ebony, rosewood, rattan, and ironwood. The logs are floated down the Salween into Burma, or to the port of Bangkok, on the Gulf of Siam by way of the Menam River, "the mother of waters," which is to central Siam what the Nile is to Egypt, serving as the chief trade route and covering the plains with fertile soil when it overflows.

For any subject not found in its alphabetical place see information

A network of east-to-west canals links the farthest villages of this region with the Menam and two other large rivers, taking the place of roads and helping to a certain extent to irrigate the land. Irrigation is backward, however, for no system exists in most of the country for raising the water onto the fields. Rice of the finest quality is grown here. Nearly the whole population, outside Bangkok, is engaged in growing "paddy," as unhusked rice is called in that part of the world. More and more of the reed and bamboo jungles, sometimes under water for three months of the year, are being cleared for rice. Enough corn and tobacco for their own use is also grown by the Siamese. The towns about Bangkok ship sago, sugarcane, coconut, and betel, and immense quantities of the tropical fruits for which Siam is famous—bananas, jackfruit, mangoes, breadfruit, pineapples, guavas, durian, and the delicious mangosteen. The rich mineral resources include tin, tungsten, gold, iron, copper, and the famous Siamese sapphires and rubies; except for tin the mines are little developed because of the unhealthful tropical climate. Three-fourths of the foreign trade is with Great Britain and her colonies, which every year, in return for Siam's products, supply many millions of dollars' worth of cotton goods, oil, silk, and machinery and other manufactures.

"A FLYING ANGEL"

A play in Siam consists largely of dances representing historical and mythological subjects, such as the march of armies, or the triumph of a conqueror. This young dancer is one of a ballet corps depicting the flight of angels.

The present area of Siam is now about 200,000 square miles (about twice the size of Colorado). It has a population of nearly 9,000,000, of whom nearly 1,000,000 are Chinese coolies and merchants. The pure Siamese are estimated at about 2,000,000; the rest of the population are Laos, Burmese, Cambodians, Malays, and Annamese, hardly distinguishable from the Siamese. The Siamese are short and stocky, with their eyes slightly slanted. They are Buddhists, and closely resemble their Burmese neighbors in having a passive easy-going temperament and giving their women much freedom. There is no caste system such as is the curse of India. As in Burma, there are numerous Buddhist monasteries, and the temples of teak with gilded roofs resemble those of Burma in symmetry. The people are, however, not so industrious as the Burmese, and most of their trade has fallen into the hands of the Chinese.

Siam aligned itself with the Allied powers in the World War of 1914–1918, declaring war on the Central powers in 1917 and seizing interned German vessels.

SIBERIA. Siberia has been to Russia what the great West was to the United States and Canada—a region of vast undeveloped resources and immense possibilities. Stretching away from the Ural Mountains to the Pacific Ocean, and from the populous lands of southern Asia to the Arctic Ocean, Siberia's lonely steppes, forests, and frozen tundras, with an area estimated at 4,832,000 square miles, exceed in extent the whole of Europe. In 1580—27 years before the

A SIAMESE FREIGHT TRAIN

This is a pack train passing through a village in Siam. In the interior of that land bullocks are the beasts of burden, equipped with twin baskets astride their patient shoulders.

first English colonists landed in America—the victories of the Cossack bandit Yermak over Tatar tribes east of the Urals opened Siberia to Russian occupation. Gold hunters, trappers, fur traders, fugitive serfs, and later transported criminals supplied the elements of a natural and peaceable expansion. "To become a colonist," said the historian Rambaud, speaking of the earlier days, "there is no ocean to cross, no steamboat fare to pay. The poorest peasant, a staff in his hand, an axe at his belt, his boots slung from a cord over his shoulder, can pass from one halting place to another until he reaches the ends of the empire." Yet the country at the time of the Russian Revolution was scarcely more developed than the American West of 50 years ago, the population of more than 10,000,000 being less than three to the square mile.

Western Siberia is a continuation on the same grand scale of the plains of European Russia, with tundras (or Arctic moorlands), great forests of birch, larch, silver fir, and other conifers, an agricultural black-earth belt, and rolling grassy steppes (*see* Russia). Eastern Siberia is rugged and mountainous or a broken table-land, with higher mountain chains or mountainous plateaus on the south and southeast. Four out of the five largest rivers of Asia, the Ob, the Yenisei, the Lena, and the Amur, drain Siberia; no other country in the world except Brazil has so many great water courses. Each receives two or more great navigable tributaries, and the upper branches of the huge treelike systems of the first three are separated only by short portages—a fact which greatly facilitated exploration and early settlement. Like Russia, Siberia has many lakes and immense swampy tracts. Lake Baikal, with a length of 386 miles, an area of 13,330 square miles, and a greatest depth of nearly 5,000 feet, is the largest fresh-water lake in Asia.

Lying in the latitudes of Labrador and Alaska, open to the Arctic Ocean but walled off by mountains to the south, with immense plains over which the terrible *burans* or snowstorms can sweep unchecked, Siberia's harsh climate is proverbial. Average winter temperatures range from 53 degrees below zero to 2 degrees above. Agriculture is impossible in the northern third, and is hampered by drouth in some portions of the interior and by excessive moisture on the Pacific coast. In the southern part of western Siberia, however, during the hot brief summer—too short for apples and pears—grain and vegetables grow like magic. Wheat, live stock, beef, and eggs are exported in large quantities; the export of butter alone in one year before the World War amounted to more than $30,000,000.

WHERE THE "SIMPLE LIFE" IS THE UNIVERSAL RULE

Life in the remoter Siberian villages, such as this, is beset by many hardships. Few of the comforts of civilization are known, and even the planks of which the cottages are made have to be hewn from the log by hand. Glass is so expensive and the long Siberian winters are so bitter that most of the houses are built with only one or two small windows. The low carriage, with a yoke at the end of the shafts, is the typical summer conveyance, as it is also in European Russia.

Siberian furs are abundant and especially rich, soft, warm, and light. The dense forests are an almost untouched source of lumber. Rich deposits of coal, iron, copper, lead, silver, gold, platinum, graphite, tin, zinc, salt, mica, and precious stones are only slightly worked. Ivory is "mined" on the Arctic coast of Siberia, where vast stores of the remains of prehistoric animals are preserved in alluvial drift.

Manufactures are insignificant because of the general backwardness of the country, and particularly of transportation. The magnificent rivers are navigable for thousands of miles, but the Ob, the Yenisei, and the Lena, emptying into the bleak Arctic Ocean, are not channels of communication with other countries, while the Amur is cut off by a great plateau from the Siberian plains; besides, all are frozen for many months in the year. The completion of the Trans-Siberian Railroad (1891–1905) gave a great impetus to the development of the country; before the World War began, more than 10,000 miles of rail had been laid in Asiatic Russia.

About two-thirds of the inhabitants are Russians and the rest consist of various native tribes of Tatar, Turk, Mongol, and other non-caucasian stocks. The conquering Mongols of the 13th and 14th centuries came from the Baikal region.

Peter the Great began the practice of exiling political prisoners to Siberia, and early in the 19th century ordinary criminals were deported thither. Late in the 19th century the government encouraged voluntary immigration. Among the important towns that grew up to populations of 100,000 or more are Irkutsk, the capital, Omsk, and Tomsk. The chief port is Vladivostok, on the Pacific coast (*see* Vladivostok). After the Russian revolution in 1917 Siberia was plunged into political chaos, serving as a base for various Bolshevist and counter-revolutionary movements, and for Japanese intervention and occupation in eastern Siberia. A Far Eastern Republic was established embracing the territory east of Lake Baikal, with the capital at Chita.

Sibyls (*sĭb'ĭlz*). According to an old Roman tradition, the Cumaean Sibyl or prophetess came from the east to the Roman King Tarquin the Proud, offering nine books of prophecies but at so enormous a price that he refused to buy. She then destroyed three, and offered the remaining six at the same price, and was again refused. Destroying still another three, she asked as much for the three left and Tarquin's fear and curiosity finally induced him to buy. They contained advice regarding the religion and government of the Romans and were carefully guarded in the temple of Jupiter and consulted on occasions of national emergency. When the temple was burned in 83 B.C. a new collection was made of about 1,000 lines, gathered from all the cities of Greece, Italy, and Asia Minor, which was kept until some time between A.D. 404 and 408, when the Christians caused it to be publicly burned.

Several other sibyls or inspired prophetesses are named by various Greek and Roman writers. Legend said they lived to an incredible age. The Sistine Chapel in Rome contains world-famous wall paintings by Michelangelo of the Cumaean, Delphic, Persian, Libyan, and Erythraean sibyls.

Sicily (*sĭs'ĭ-lĭ*). On the walls of a Moorish palace in the Sicilian city of Palermo runs this legend: "Europe is the glory of the world, Italy of Europe, and Sicily the fairest garden of the Mediterranean." This "fairest garden" is the largest island in the Mediterranean. Mount Etna, which dominates it now as always, looks down upon an unsurpassed panorama of curving bays, shining cliffs, and crowded fishing villages perched like nesting sea-birds among rocks and crags. The landscape shows rugged mountains dark with evergreen, and rounded hills gray-green with olives and terraced vineyards, as well as yellow sun-baked plains and valleys carpeted with orchids, iris, and anemones, and many quaint old towns and cities.

Picturesque towns are these, with their vine-covered walls, their gardens and fountains, and their ancient palaces and churches, flooded with sunshine and the heavy fragrance of flowers. At Etna's foot, on the east, directly across the Messina Straits from the toe of the Italian boot, lies Messina. This great seaport was founded by the Greeks about 600 B.C. under

A RUINED MEMORIAL OF THE DAYS OF THE GREEKS

At Taormina on the east coast of Sicily, you may see these ruins of a theater which was originally built by the Greeks. But while the columns are Greek, the arches you see are Roman, for the original theater was entirely reconstructed by the Romans. From these ruins you get a beautiful view of Mount Etna in the background.

the name of Zancle (the Greek word for "sickle"), referring to its peculiarly shaped harbor. From the earliest times it has been of commercial importance. Even the ancient Phoenician trading vessels threaded their way between the fabled rocks of Scylla and the perilous whirlpool of Charybdis in the straits outside the harbor. Messina today is a wealthy modern city humming with industry. Its inhabitants have shown their pluck in the face of centuries of disasters, culminating in the terrible earthquake of 1908 which almost completely destroyed the city. More than 77,000 persons were killed and about 80,000 were injured. Famine and pestilence, following in the wake of the disaster, caused many more deaths.

Near Messina, along the eastern coast, is Taormina, perched on the rocks like an eagle's nest, 700 feet above the Ionian Sea. Far to the south past Catania stretch yellow plains to the famous Syracuse, once the greatest city of Sicily, now reduced to a mere shadow of its ancient splendor. Across a temple-crowned shell-shaped valley on the southwestern coast lies Girgenti. On the northwestern coast at the mouth of the orange-bowered "Golden Shell" valley lies Palermo, the largest city in Sicily and the fifth largest in Italy. Its population is about 346,000.

Palermo may fittingly be called "the melting pot of the Mediterranean," for the Phoenicians, Carthaginians, Greeks, Romans, Goths, Saracens, Normans, French, and Spaniards who have ruled there have all left their marks on this old-time city. Its beautiful harbor is filled with fishing boats with bright-colored sails, and great steamers loaded with lemons and sulphur. In the streets tourists mingle with gaily costumed peasants, who look like grand-opera heroes with their bright sashes and gay shirts, proudly riding in their wonderfully carved and gaudily painted two-wheel carts drawn by donkeys covered with plumes and tinseled harness. Palermo has other interests, too, besides its commercial ones. The University of Palermo, founded in 1779, has recently risen in importance and now has more than 1,000 students. The city is a military post and has a large arsenal. Near by is a royal winter palace.

The Power of the Mafia

Because the elementary schooling is so poor many of the Sicilians—especially the sunburnt fishers, mountaineers, and other poor but picturesque peasants—are very illiterate. The poor laborers—notably the sulphur workers—have a very hard time, and many of them leave their sunny island and go to the United States. The Mafia, a powerful secret organization which terrorized the entire island and even has its secret agents in the United States, is the curse of Sicily, as the Camorra is of Naples. By boycotting or by violence the Mafia controls elections and trials, protects its members from officers of the law, and often prevents non-members from securing employment. Most of the crimes in Sicily and many of the mysterious murders in the Italian quarters of American cities are laid at its door.

Sicily's history is a tale of changing masters, of conquests and cruel oppression. It was first great under the Phoenicians nearly 3,000 years ago. With the Greeks, who arrived in the 8th century B.C., came Sicily's intellectual "golden age." The poet Theocritus, the philosopher Empedocles, and other great men of Greece trod her streets, and beautiful Grecian temples were built. Then came the Carthaginians, who soon had to yield to Rome. Vandals and Goths found their way across the narrow straits from the mainland, pillaging and destroying. Then the Byzantine rulers of Constantinople sent armies to drive out the barbarians and held the island against the marauders for a brief period.

With the Saracens in the 9th century came a new epoch. Agriculture, industry, and commerce once more flourished. Then the battle for Sicilian soil began again. First of the invaders from the north were the Normans. Under Emperor Frederick II (1197–1250) Sicily attained what was perhaps the zenith of her culture, at this time becoming, indeed, the cradle of Italian song, and one of the first of modern states. Sixteen years after Frederick's death Charles of Anjou overthrew the last of the Hohenstaufen dynasty, but his cruelty and oppressive taxation greatly angered the Sicilians. Matters came to a crisis on the day after Easter in 1282, when, as the vesper bells were ringing, the people of Palermo massacred 4,000 of their French oppressors. Massacres in other parts of Sicily followed this famous "Sicilian Vespers," after which independent Sicily chose Pedro III of Aragon for king.

A Long Period of Misrule

Spanish, French, and Austrian despots then brought a long period of darkness and stagnation. In 1734–35 Don Carlos established the Bourbon dynasty in Naples and Sicily, uniting the two territories under the name of the Kingdom of the Two Sicilies; and down to 1860 Sicily was governed by Bourbon kings. Then Garibaldi with his thousand "red shirts" came to deliver the Sicilians, finally annexing Sicily to the dominions of Victor Emmanuel, which a year later became the Kingdom of Italy. The island is now divided into seven Italian administrative districts or provinces.

Sicily is separated from the Italian mainland only by the narrow Strait of Messina (*see* map of Italy). It is a fragment of the long narrow land-link which in prehistoric times joined Italy to Africa. Its area of 9,935 square miles is a little greater than that of Vermont. Its chief exports are sulphur, fruits (grapes, olives, oranges, lemons, etc.); fish (a great supply of tunny, sardines, as well as sponges and corals, are taken from Sicilian waters); wine, oil, sumac, and salt. Population, about 3,800,000.

SIEGFRIED (*sēg'frēd*). Long, long ago, in a gloomy cave hidden away in the forests of the Rhineland, there lived Siegfried, a kingly youth, tall and strong, with fair hair and blue eyes. His only companion was Regin, a swarthy dwarf who had reared him.

When Siegfried attained manhood Regin told him of his parentage, that he was the orphaned son of a fearless king who had died gloriously in battle. "The time has now come," Regin said, "when you must leave the forest and go in search of adventure in the world." Nothing loath, Siegfried prepared to depart, but first he asked that Regin make him a trusty sword. Regin, who was a skilled smith, straightway began to forge a sword for Siegfried, but when he had finished it the youth easily shattered it by striking it on the anvil. Three others met the same fate.

"If I am to do battle," said Siegfried, "I must have a sword worthy of my strength." Thereupon Regin took the broken pieces of the sword which had belonged to Siegfried's father, filed them into steel dust, and from this with all his art he made a wonderful shining blade. This also Siegfried tested by bringing it down with a mighty blow on the anvil. It was not broken, but the anvil was cut in two.

Fafnir, the Terrible Dragon

In the long evenings Regin had told Siegfried of the fearful dragon Fafnir who guarded in his cave a priceless treasure, slaying those who tried to gain it. To the den of the dragon Siegfried now made his way. When Fafnir heard him approaching he roared until the ground trembled. Nothing daunted, Siegfried guarded himself from the maddened rushes of the hideous creature, until with a thrust of his sword he so wounded the dragon that it at last fell dead. Siegfried thus gained the treasure which the monster guarded. By bathing himself in the blood of the slain dragon he became proof against wounds, excepting in one small spot between the shoulders where a linden leaf had fallen. Accidentally tasting the blood, he discovered that he was able to understand the language of the birds and beasts, and by eating the monster's heart he was endowed with even greater strength. According to another story the treasure which Siegfried gained was obtained by slaying the kings of the Nibelungs (*see* Nibelungs, Song of the).

After performing many other great feats Siegfried at last came to the court of Gunther, king of the Burgundians, where he was greeted as a hero, with feasts and all honor. He wedded Kriemhild, sister of Gunther, a maiden of marvelous beauty, and became the most heroic and beloved knight in Gunther's kingdom. But among the king's vassals was one, Hagen by name, who was jealous of Siegfried's glory. By clever lies he induced Gunther to believe that Siegfried would some day steal his power, so the king agreed to help destroy Siegfried.

Knowing that there was but one place in which Siegfried could be wounded, Hagen treacherously played upon Kriemhild's fear for Siegfried's safety on the battlefield, and begged her to tell him of the fatal spot, saying, "I ride close behind your lord in battle, and should the fight wax fierce, knowing his vulnerable spot I might protect him." Kriemhild innocently disclosed the secret, and unknown to Siegfried she sewed a tiny cross between the shoulders of his tunic. The dauntless hero thus became an easy prey to those who sought to slay him. Gunther arranged a hunt, and the cowardly Hagen thrust a spear into the fatal spot, while Siegfried lay drinking from a woodland stream. Mortally wounded, Siegfried attacked Hagen but died before he had avenged himself. The whole kingdom mourned Siegfried's loss, and it is said that even the gods sorrowed and there fell upon the earth a gloom that lasted for many days. This story is the theme of one of the musical dramas of the composer Richard Wagner.

SIERRA (*sĭ-ĕr′ȧ*) **NEVADA.** The loftiest and grandest mountain range in the United States, the Sierra Nevada ("snowy range") forms a great wall extending for nearly 500 miles in the eastern part of California between the deserts of the Great Basin and the rich grainfields and orchards of the Sacramento and San Joaquin river valleys. The eastern slope plunges abruptly to the plain 5,000 feet below; the western has a wider, more gradual slope, covered with forests. The crest is a line of sharp snowy peaks.

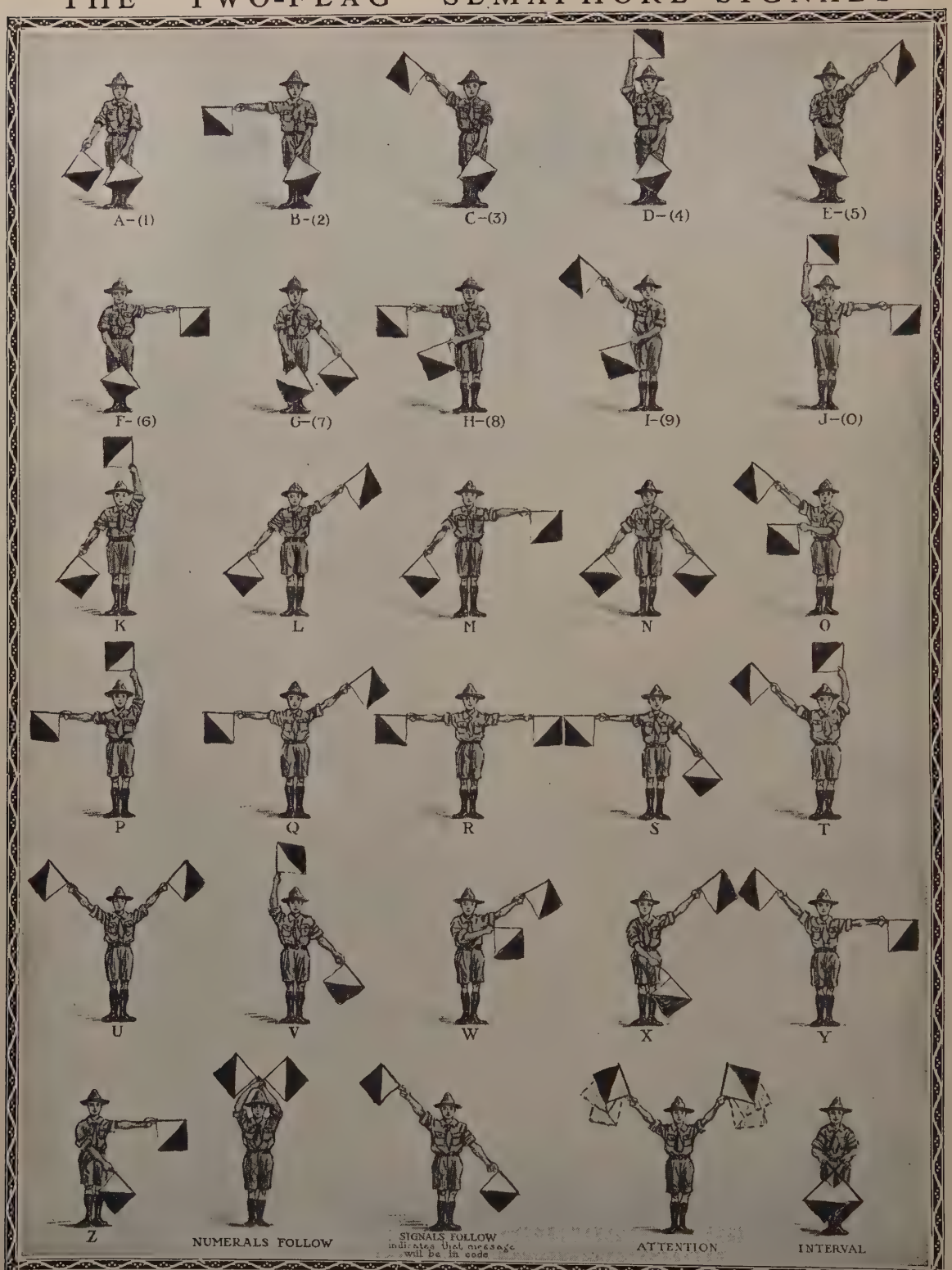
Mount Whitney, near the southern end of the range, is the highest peak in the United States (outside of Alaska), attaining a height of 14,502 feet, and there are a number of other peaks more than 13,000 feet high. Mount Shasta at the northern extremity is an extinct volcanic cone, almost as high as Mount Whitney, with a crater about 2,500 feet in depth and 3,500 feet in diameter. Not far south of it is Lassen Peak, the only volcano in the United States proper which is still active. Many of the summits are clad in perpetual snow, and there are some small glaciers.

Fed by the heavy snowfall, many torrents have cut their way down the western slope, forming deep canyons. In other places great chasms have been formed by the splitting asunder of the rocks or hollowed out by glaciers. Among the valleys the Yosemite is the most famous and the most magnificent (*see* Yosemite Valley). The lower western slopes are covered with oaks and other deciduous trees; above these, to a height of 9,000 feet, are dense forests of many kinds of evergreens, including the giant sequoias, the largest trees in the world (*see* Sequoia). The range was named by the Spanish settlers after the Sierra Nevada in southern Spain, the highest mountain range in that country.

SIGNALING. Even the most primitive of peoples have always had systems of signaling by which they could transmit information over long distances. For short distances the early signals were chiefly gestures or signs with the hands or body. For longer distances, especially in warfare, beacon lights, such as fires and torches, were used, as well as smoke columns, the display of shields, spears, banners, etc. Who has not pictured on the background of romance the beacon fires by which the Indians, signaling from one mountain peak to another, summoned their councils?

These early methods seem crude indeed in comparison with the modern telephone and telegraph.

THE "TWO-FLAG" SEMAPHORE SIGNALS



Here are the positions you would use in sending a message by means of two hand-flags. You will notice that the first ten designate both letters and numerals. The rule is that these positions usually designate letters; but if you give the "numerals follow" signal each subsequent position means a numeral, until you give an "interval." Then each position means a letter. The method is exceedingly rapid and is not very difficult to learn.

For any subject not found in its alphabetical place see information

But even today various signal systems are in use and are of the greatest importance, especially at sea, in military operations, on railroads, and in weather bureau activities.

At sea, signaling is one of the important phases of navigation. Most nations have adopted the International Signal Code, comprising an alphabet of flags in variously colored designs, and a 27th flag or answering pennant. Three flags are generally used for each signal. When the flag colors cannot be made out—they are visible for only about three miles—other systems are used. Little cones, balls, and drums may be fixed in vertical arrangements, or a fixed "semaphore"—a post to which one or two mechanical arms are attached—may be operated.

Before the invention of the electric telegraph, the semaphore was extensively employed in Europe as a means of transmitting messages. Codes for spelling out any message were devised, in which different positions of the signal arms stood for different letters. The semaphores were set far apart and operators observed the changing signals through telescopes. A system of this kind between Lille and Paris conveyed messages 130 miles in a few minutes. Today, however, the semaphore finds its principal use as a signaling device on railroads.

Signals Used at Sea

The United States Navy makes considerable use of a signaling system which is based upon message books. The books contain almost all the communications a ship might want to make, and in signaling from one ship to another it is only necessary to indicate by flags the book and the number in the book corresponding to the required message. Nine rectangular flags, representing digits from 0 to 10, and three triangular pennants called repeaters are used. In addition there are special flags—annulling flags, convoy flags, position pennants, etc. Hauling down the ensign indicates the completion of a signal. One of the commonest systems for short distances is the "two-flag semaphore," in which a sailor, perhaps standing aloft on a signaling bridge, waves two square flags, one in each hand, the positions of the flags indicating the letters of the alphabet. In the one-flag "wigwag" system, the dots and dashes of the International Morse Code are used, with a movement of the flag to the right for a dot and to left for a dash.

Night signals include red and green fireballs or stars, which are shot to a height of about 400 feet and are visible for 10 miles or more, and red and white lights. White lights are also flashed from "blinker lamps," the long and short flashes indicating dashes and dots. Ships below the horizon as much as 60 miles distant may be signaled by turning a searchlight beam upon the clouds.

But the wireless telephone and wireless telegraph have largely displaced the older methods of signaling, particularly in distress signaling. A famous instance of the latter was the "S O S" signal of the sinking *Titanic*. The call brought the steamer *Carpathia* speeding over miles of water in time to rescue many of the ill fated liner's passengers.

In fogs and storms, signals are sent out at regular intervals from ships and shore stations by bells, sounding horns, sirens, or whistles. Scientists are also developing methods for submarine signaling, in order to take advantage of the fact that sound is conveyed more uniformly through water than through air. Submarine signals usually are made by strokes of a bell or beats of a metallic drum, immersed far enough below the surface to be free from wave disturbances. The ship picks up these sounds by means of microphones, or sensitive receivers, hung in water tanks inside the ship's bows. These microphones are electrically connected with an indicator box in the pilothouse or chart room. Such signals are used to indicate the presence of shoals, harbor mouths, nearby ships, etc.

Signaling in the Army

Except within regiments and smaller units, signaling in the United States Army is the work of a special branch, the Signal Corps, founded in 1860. Army signals include the wigwag, wireless telephone and telegraph, the field telephone and telegraph, "blinker" lamps, ground induction sets, lanterns, rockets, bombs, semaphores, searchlights, and elaborate sets of signals for exchanging information between aviators and the ground. The airmen give signals by means of wireless telephone and telegraph, smoke bombs and streamers, and receive signals from the ground by means of cloth strips laid out in different patterns, blinker lamps, and flares. Another of the Army signaling devices is the heliograph, an instrument in which a mirror reflects the rays of the sun cast upon it. Messages are sent by short and long flashes, corresponding to the dots and dashes of the Morse Code.

The Army uses both the International and the American Morse Codes, and both the Army and the Navy have secret codes and signals of various sorts. The Boy Scouts use the International or General Service Code, as it is more often called, with one flag, and the two-flag or Semaphore Code.

SILICON. This element might well be called "the earth-maker," for the earth's crust is composed largely of a combination of silicon and oxygen called silica (SiO_2). Quartz, which occurs both by itself and as a constituent element of granite, is a crystalline combination of silica and water, while sand, clay, and most other forms of soil contain silicon in one combination or another. Silicon never occurs free in nature, and its combinations are rarely found in living substances.

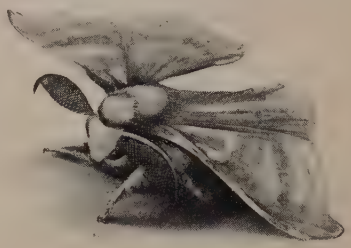
In the arts and industries, silicon is important because in the form of silica it enters into the composition of many precious stones, glass, and varieties of earthenware. Silica colored with other materials gives amethyst, cat's-eye, jasper, chalcedony, agate, carnelian, onyx, and opal. Glass consists of varieties of silica fused with other materials, and in the finished product silica constitutes from 50 to 75 per cent of the whole. Clays contain from 45 to 60 per cent silica.

When united with equal parts of carbon in the intense heat of an electric furnace, silicon yields the artificial substance carborundum (SiC), which is next to the diamond in hardness, and is widely used for whetstones, grinding wheels, and polishing and abrading powders. Carborundum was first obtained by accident in 1891 by E. G. Acheson, an American who was trying to make artificial diamonds. It is so resistant to heat that a coating of carborundum and fire clay one-twelfth of an inch thick is said to be able to protect the brick lining of a furnace against any heat ordinarily used, even in melting iron and steel. Carborundum is made at Niagara Falls, by fusing a mixture of 34 parts of coke, 54 of sand, 10 of sawdust, and 2 of salt for 36 hours in an electric furnace.

Pure silicon may be obtained by chemical processes either as a non-crystalline brown powder or a crystalline gray one. Silica united with hydrogen and oxygen in the form H_4SiO_4 constitutes silicic acid, which acts upon many substances to form silicates. Silicates form the principal minerals in soils.

Silk Worm

THE LITTLE SPINNER *and Its Dress of Silk*



Silk Moth

SILK. Once upon a time a dainty little empress sat in her garden watching the sun shining down on her mulberry trees, while the fountains bubbled with laughter and the wind brought to her the fragrance of the spring. This empress lived more than 4,500 years ago, the story goes, in Hang-Chow-Foo, the "City of Heaven," which was the old southern capital of China, and her name was Si-Ling-Shi. Presently she saw a caterpillar on one of the branches making for himself a beautiful little house with threads spun from his body.

All day long the empress watched the caterpillar. She saw that from the under side of his head flowed a shining thread, which he wrapped around and around his body until he was all enclosed in a delicate little cocoon which looked as if it had come from fairyland.

"But the whole beautiful thing is just one long thread, wound as if on a distaff!" cried the empress. "If I could only unwind it, what an exquisite fabric it would make! Why couldn't I? I believe I could, for there is not one little tangle in it. It just needs patience."

So she coaxed the emperor to give her a grove of the choicest mulberry trees. And there she worked, carefully gathering the tiny eggs of the silkworm moths, and when they were hatched picking with her own hands the tenderest leaves for the baby worms to eat, until the time came when they, too, had spun their exquisite cocoons. And one happy day she succeeded in twisting together the strands from a number of the little silk balls into many long threads. Hundreds of yards she wound off, and from them she wove a wondrous shimmering fabric more beautiful than any that had ever been seen before. To this day it is called "si" in China, "soie" in France, and "silk" in English-speaking lands, in honor of clever Si-Ling-Shi.

FOOD FOR THE SILKWORM GUESTS

After Lady Moth has laid her eggs and after these eggs have turned into the little worms that spin the silk, comes the busy time of the gatherers of mulberry leaves. These Japanese are gathering a load for the voracious babies, who eat their own weight in mulberry leaves every day of their lives!

All over China the culture of the silkworms spread, and when the empress died the southern part of the empire was a bower of mulberry trees, and Hang-Chow-Foo was famous for its beautiful silks and embroideries. The empress was placed among the Chinese deities as the "Goddess of the Silkworms," and every year when the mulberry leaves open there is a feast day in her honor.

While this is only a legend, it bears witness to the fact that silk culture was known in China from a very early time. For more than 2,000 years the

Chinese manufactured silk and sold it to their neighbors in Japan, India, and Persia. But the secret of how it was made was faithfully kept by the Chinese, though it was known to hundreds of millions of the vast empire's population.

When Alexander the Great swept with his victorious Greeks through Asia into India, about 330 B.C., he carried back with him to the Mediterranean lands the first raw silk that Europe had ever seen. But he did not get the most important thing of all, the secret of the silkworms, which remained locked in the strange old walled country of China until 300 years after the Christian era. Then it was carried to Japan by four Chinese maidens, kidnapped by the Japanese from a silk-weaving village. At about the same time a Chinese princess, who had married an Indian prince, is said to have carried silkworm eggs hidden in her headdress to her new home, and taught her new subjects this valuable art.

But the knowledge of silkworm culture spread very slowly, and as late as 550 A.D. all the silk in the Roman Empire was brought by caravan over dangerous overland routes from Persia and India, which made it so expensive that it was an extravagance even for emperors. Not until Justinian's reign (527–565) were the first silkworms brought to Constantinople. Two Persian monks who had lived in China were induced by the emperor to go back to that land and try to procure some of the silkworm eggs. If their purpose had been discovered they would certainly have been killed, but they returned safely with the precious eggs concealed in their hollow pilgrim's staffs, and from those eggs were produced the silkworms which supplied the western world for 1,200 years.

The new industry spread slowly from Constantinople. Under the conquering Saracens it was carried both east and west. Sicily became one of the homes of silk cultivation and manufacture, and the art spread next to Florence, Milan, Venice, and Genoa, all of which became famous for their beautiful fabrics. Silk manufacture began in France as early as the 13th century, but the production of cocoons was not successfully begun until the close of the 15th. About the same time England began to manufacture fabrics from imported silk skeins, but all attempts to breed silkworms there have failed. After 1685, when the Edict of Nantes was revoked, 400,000 Huguenots, many of whom were especially skilled in weaving silk, fled from France to England, Switzerland, and Germany, and gave tremendous impetus to the growth of the industry in these countries.

All attempts to introduce silkworm culture into the United States have failed, although far more silk is manufactured and used here than in any other country. About 1838 a variety of mulberry tree, which was said to be adapted to culture in the United States was extensively introduced, but growers soon found that the trees were not hardy enough to withstand the northern climate, and a fatal blight in 1844 completed the downfall of the industry. (*See* Mulberry.)

It is now realized that the culture of raw silk can be profitably undertaken only where there is an abundant supply of cheap labor, since the care of the worms and the preparation of the raw silk requires much patient attention. Today raw silk is produced in considerable quantities only in China, Japan, India, France, Italy, Persia, and Turkey. Bengal is one of the ideal silk-raising districts of the world, for the climate there permits of three crops of cocoons a year—one in March, one in July, and one in November. Some of the other countries have two crops, others only one.

AFTER THE SPINNING IS DONE

These little spinners have finished their spinning and the silk dresses they have made for themselves will soon be converted into dresses for other people. The upper picture shows a group of silkworm cocoons in their nests on branches of brushwood laid in racks like those of the picture below. The Japanese girls are removing finished cocoons.

THE REELING OF THE SILK

After the cocoons have been gathered and the young worms have been killed by dry heat or steam, they are sorted according to color, size, and quality. Then the delicate threads from several cocoons are unwound and laid together so as to make a single strand and these strands are wound on reels. In the small communities of Japan, reeling is done as you see it here, but silk reeled in this way is apt to be uneven and lumpy. The best silk is reeled in large factories by machinery.

Though Asiatic countries grow the bulk of the world's silk, they manufacture little more than they use themselves. The western nations, with their improved machinery, are able to manufacture more cheaply. The silk-weaving industry in the United States is comparatively young, having grown up almost entirely since the Civil War. Between 1899 and 1914, the value of its products more than trebled. The manufacture flourishes chiefly in the eastern states, especially in New Jersey, Pennsylvania, New York, and Connecticut. Other important manufacturing countries are France, Germany, Switzerland, Italy, Russia, and Great Britain. The workers are usually women, and in Pennsylvania and some other states they are often the wives and daughters of workers in the coal mines.

OPENING A BALE OF SILK

The reels of silk are shipped in bales with matting covers. This bale is being opened at a silk mill at South Manchester, Connecticut.

The wonderful little silkworm that makes all the world's silk is hatched from a tiny egg about the size of a pin's head. In the early summer the mother moth lays from 200 to 500 of these eggs on strips of paper or muslin prepared for her. They are kept in a cool dark place, and in the spring are put into trays and hatched by artificial heat. When the young worms or larvae emerge from the eggs they are little dark wriggling creatures about a quarter of an inch long. They have prodigious appetites, and soon they are eating their own weight in mulberry leaves every day. They grow so fat that they shed their skins four times before they are full grown. It takes about a ton of leaves to raise from 30,000 to 35,000 of the worms.

In four to six weeks the worms have become plump, grayish-white caterpillars, about $2\frac{1}{2}$ inches long, and they are ready to spin their cocoons. They then climb up the brushwood branches or the many-celled racks prepared for them, and begin the work for which they

WHEN THE SILK GETS TO MILL

After the silk has been washed, it is straightened, as in the top picture. In the center you see a twisting machine at work. The third picture shows a row of spinning machines.

have been so carefully reared. On both sides of their bodies are glands which have become filled with thick glue-like material. The worms now press this out in two slender threads which stick together as they emerge from an opening in the upper lip, called the "spinneret." The fluid threads at once harden in the air into the tough silk fiber, and the larvae weave them into cocoons completely surrounding their bodies, by bending their heads forward and backward in a figure-eight loop, presenting a most comical aspect at the task. In three or four days the cocoons are completed. In shape and size they are somewhat like pigeons' eggs and each contains from 500 to 1,200 yards of continuous thread.

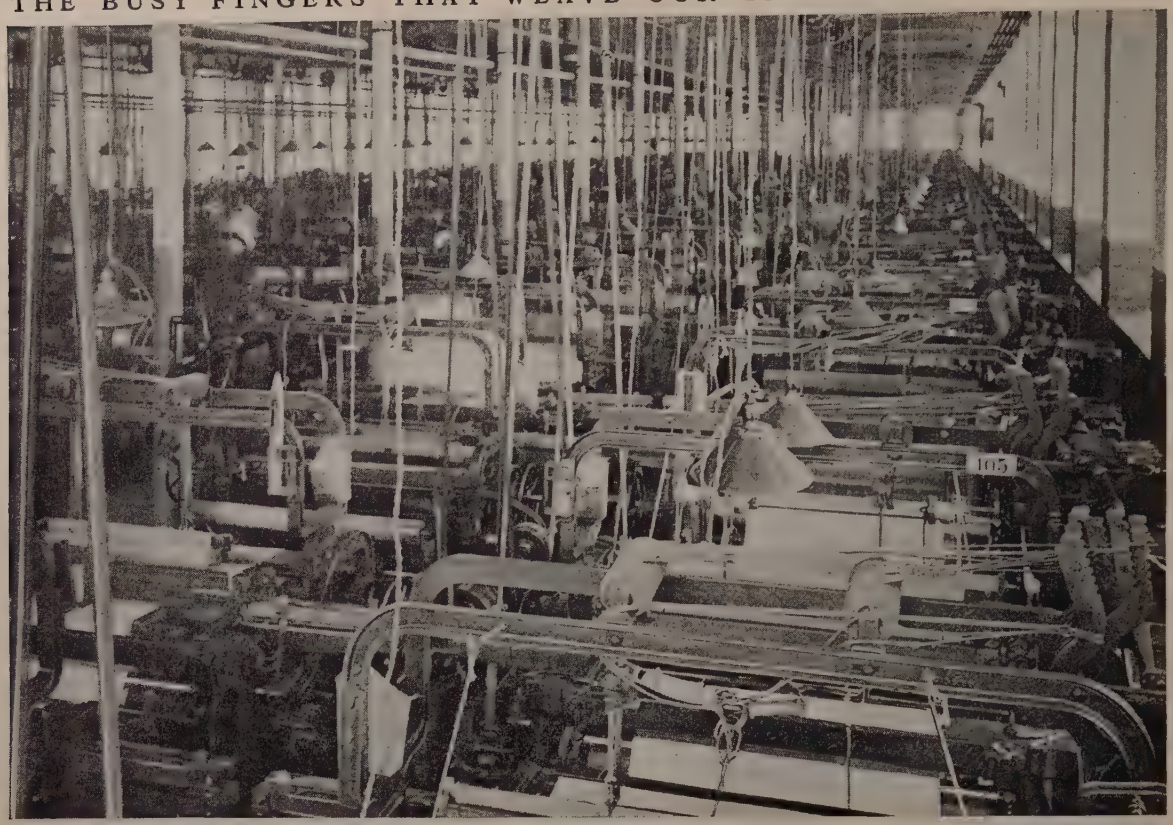
Usually the cocoons woven by domesticated silkworms in the Orient are white or light yellow, but nearly all the cocoons woven in western countries are yellow. In some parts of the Far East the cocoons of other insects akin to the silkworm are used to a certain extent, but their cocoons are not so good as those of the domesticated silkworm. These "wild silks"—the commonest and best of which is called *tussur* silk because it comes from the tussur worm—are usually écru or pale green in color. Familiar examples of these fabrics are pongee, rajah, and shantung silks. The coloring matter in wild silks cannot be removed by boiling, as in the silks of the domesticated insects, so the wild silks will take only the darker dyes.

Cast-off Silks Made as Good as New!

Two or three days after the cocoons are completed they are gathered and sorted. A few of the best are put aside in a warm place and carefully guarded until the developed moths bore their way out, to lay eggs for next season's brood of worms. The rest of the cocoons are put in a hot oven, or exposed to the sun's rays under glass, to kill off the worms within before they start breaking out of the cocoons and ruin them.

The next step is the exceedingly

THE BUSY FINGERS THAT WEAVE OUR SHIMMERING FABRICS



This shows the interior of a silk weaving mill. The "warp" threads—those which run lengthwise of the fabric—are first attached to a beam side by side. The beam is then placed in the back of the loom and the warp is unwound from this, each thread passing through an eyelet. As the machine revolves the warp threads are constantly lifted and lowered, and in the opening made by this rise and fall the shuttle carrying the "weft" thread flies across the warp.

delicate and laborious process of removing the fiber from the cocoons. First they are soaked for a few minutes in hot water to soften the gummy coat, while a girl with a small twig brush constantly stirs them. The outside of the cocoons is a coarse flossy covering of loose fibers, which adheres to the twigs and is so removed. Then the cocoons are put into trays filled with warm water, and the ends of several of the long threads are brought together and passed through a tiny guide like the eye of a needle. The fibers stick together to form a single strand and are wound upon a reel.

When the reel is full the silk is taken off in large hanks, and this is the form in which most raw silk reaches the United States. It takes from 130 to 140 pounds of cocoons to yield 12 pounds of raw silk, and the fastest workers can reel only a pound or two a day.

In many places the reeling is done by machinery, which not only increases the speed but also produces more even threads.

Before the silk is ready to be woven on the loom, it must go through the process known as "throwing." In this operation several threads are twisted and doubled into a more substantial yarn, while any thick lumps or imperfections are removed. One pound of good quality raw silk will yield enough unspun thread to reach from Philadelphia to New York and back—a distance of 181 miles. "Tram" silk, used for the woof in weaving, consists of two or more threads twisted together. To make "organzine," which is used for the warp of heavy fabrics, the threads are double-twisted. This is done on machines which twist the threads about 16 turns to the inch in one direction, then double it and twist it about 14 turns the other way. To convert a single pound of raw silk into organzine requires 264,000,000 revolutions of a spindle, so it is easy to understand why the throwing is not done in the Asiatic countries where the machinery is crude.

Silk Dresses that are Half Tin!

The yarn must now be scoured or degummed to remove the gummy coating and coloring matter, by steaming or boiling in soapy water. This robs the silk of about one-fifth of its weight—a serious loss where raw silk has sometimes cost more than $5 a pound. To make up for this shrinkage it is the common practice to "weight" the silk threads by putting them in a bath of tin dissolved in hydrochloric acid. By alternating this bath with another containing phosphate of soda, it is possible to continue the

"MUSIC" CARDS THAT PLAY IN PATTERNS

Isn't the world of invention as full of surprises as a fairy tale? Take the wonderful Jacquard loom, for instance, which you see weaving those pretty patterns in silk. Much the same device that is used in your player-piano perforated cardboards—you see them folded up overhead—controls the action of the needles that weave these patterns; causing them to skip and dip among the threads, precisely as if each one had a human hand and a human brain behind them! The cards, like the piano player rolls, have holes in them which control the needles as the holes in the player roll control the keys.

contained in the Easy Reference Fact-Index at the end of this work

process until a pound of raw silk, which shrunk to 13 ounces when it was degummed, has taken on enough tin to weigh from 20 to 60 ounces! Some silk fabrics are thus more than half tin. This weighting lessens the durability of the fabrics, and makes them harsh and crisp so that they crack where they are folded; but it greatly reduces the cost, and it is most used in the cheaper silks.

After the silk has gone through these processes, and has been bleached (if for white fabrics) or dyed (if for colored fabrics), it is ready for weaving (*see* Spinning and Weaving). Waste silk, that is the "floss" silk from the outside of the cocoons, and the large proportion—about three-tenths—of the inside of the cocoons that cannot be unwound, is treated much like wool, and is spun into threads called "spun" silk. This is used for silk yarns and for making fabrics of less durability than true silk.

Almost one-half the silk manufactured in the United States is used for dress goods. A garment of pure silk lasts a very long time, for there is hardly any material that wears better. The silk from worms fed on the ailanthus tree wears better than from the worms fed on the mulberry tree, but it is not so soft and glossy. Silk velvets, ribbons, hose, silk fringe, embroidery silks, silk yarns and threads, and beautiful upholstery fabrics are also important branches of the silk manufacturing industry.

Use of Silk in War and Industry

But silk is not merely a soft creation of the boudoir and the drawing room. The sturdy side of this lovely fabric comes to the front in the grim days of war. Then great observation balloons made of silk soar above the battlefields; tiny silken parachutes uphold the dazzling "star-shells" that float over No-Man's Land at night to guard against surprise attacks; and powder charges for some types of guns and trench mortars are contained in bags of silk. Silk is also used for many purposes in industry—for example, in the "bolting cloths" used in sifting flour.

Artificial silk, usually called "fiber silk," is a fabric entirely different from pure silk, but it possesses a silken luster. Indeed, artificial silk may be the more lustrous of the two, but it has a very different feel. It is made by the action of various chemicals on cotton or wood-pulp, which forms collodion (*see* Collodion). This is then forced between rollers, next through tubes into diluted nitric acid, where the minute streams of collodion are converted into fibers. These fibers are then wound on reels and dried, and subjected to a variety of washing and drying processes, until they are ready to be spun. Since fiber silk is usually not weighted with tin it is more durable than most real silk, and quality for quality it is cheaper. It is much used for hosiery and the beautiful knit fabric called tricolette.

Scientific name of silkworm moth, *Bombyx mori*. It belongs to the *Bombycidae* family of the moths. The body is about half an inch long, and the outspread wings measure about two inches from tip to tip. The domesticated silkworm has been so weakened by the artificial life to which it has been subjected that it has been robbed of its natural strength and has become subject to many serious diseases. Hundreds of bacteriologists are kept busy studying the microbes that prey upon this little animal and seeking means to combat them.

SILOS. Storing green crops in a silo is like bottling up a pasture for use during the winter months or for use all the year around to take the place of pasture land partly or entirely. Nearly every well-equipped farm has one or more of these tall cylindrical structures in which to store up fresh juicy foods for the stock, much as fresh fruits and vegetables are canned for human use. Dried grains and fodder unmixed with green foods are not only expensive for feeding stock, but are so unsatisfactory for milch cows that it was common practice to allow them to go dry during the winter months. The ensilage or silage, as the contents of the silo is called, rivals the pastures of June in providing the succulent foods so necessary for the dairy herd, as well as other farm stock, and it is especially useful in promoting the healthy growth of young animals.

Corn, which is the principal silage crop, is cut before the juices of the green plants begin to dry out in the fall. The entire plant—stalk, leaves, and ears—is chopped into short lengths by machinery so that it will pack readily, and put directly into the silo. If the corn is too dry, water is poured over it as it is packed away. It is estimated that food equivalent to four tons of hay can be produced ordinarily from one acre of corn. This makes corn preserved in a silo a very economical crop, especially as it is so compactly and economically stored. Clover, oats, rye, sorghum, alfalfa, cow peas, beans, millets, and wheat may also be used as silage when cut green. Recent experiments with sunflowers for silage have been very successful, the yield being twice that of corn. Green material closely packed in an air-tight silo will keep in good condition for many months. Although some chemical changes take place, the composition and feeding value of silage is practically the same as that of the green plants.

The silo, which has brought about some of the most important changes in modern agriculture, was introduced into America from Europe about 1875. The first silos were pits dug in the ground into which the crops were packed and covered over with straw and sod. The modern silo is above ground and is built of wood, brick, stone, or concrete. Concrete is favored in most localities because it is durable, air-tight, water-proof, and vermin-proof. Practically all silos are built in cylindrical form, leaving no corners where air spaces may cause the spoiling of the silage. They are made tall with small surface area so that the silage may be used from the top fast enough to keep the surface from spoiling.

SILVER. Late in the spring of 1859 two grizzled miners were busy with pickax and shovel in the barren wilderness near where Virginia City, Nev., stands today. They were digging a reservoir to collect water for their crude mining operations. For months

THE ART OF THE SILVERSMITH

These pictures tell the story of that silver cup at the bottom. The figure on the cover is cast in the mold the masked workmen are pulling from the furnace. The rest is modeled by hand. First a silver sheet is fixed around a wooden form or "chuck." This revolves in a lathe while the circular designs are pressed in with steel tools. The embossed portions are tapped out by a steel mallet set vibrating in a vise. The cover rim is hammered out by hand, and certain other portions of the design are stamped by a press, or "chased," that is driven in with the blows of a punch. Last of all comes the polishing against a spinning wheel.

contained in the Easy Reference Fact-Index at the end of this work

the gold dust they had been able to wash from the nearby gravel banks had scarcely provided a living.

At a depth of four feet one of the miners felt his pickax strike a hard substance, a heavy black dirt very different from the surrounding yellowish gravel and clay. Completely ignorant of the nature of the substance, they washed it in their "rockers." They were disappointed to find, instead of fine yellow gold, a much lighter-colored metal, barely tinged with a golden hue. Not long afterward they sold their discovery for a small sum, little realizing that it would turn out to be the world-renowned Comstock mine, one of the richest bodies of silver ore ever unearthed. The little strip of ground in which this famous ore-body is situated produced in 30 years more than $300,000,000 worth of silver and gold. This tremendous production affected the value of silver and upset the money standards of the whole world.

Tragedy pursued the original discoverers of this huge deposit of wealth. One, Patrick McLaughlin, died in a few years so poor that he was buried in a pauper's grave. The other, Peter O'Riley, died insane, cherishing the belief that spirits were leading him on to the discovery of another "Comstock." H. T. P. Comstock, who had claimed the honor of the discovery, giving his name to it, killed himself ten years later after brooding over the fortune he had let slip through his hands.

Although the Comstock lode remains perhaps the most spectacular discovery of precious ores recorded, it is typical of scores of others. In fact, the entire history of gold and silver—for the two are commonly found together—is interspersed with a thread of romance, adventure, and exploration which makes it read like an 'Arabian Nights' tale. The story of Diego Hualca, a poor Indian hunter, is only one of many. While pursuing a goat up the side of a mountain in Peru, in the year 1545, he grasped a jutting bush for support. The bush came out, root and branch, in his hand, and revealed to his astonished eyes the surface outcroppings of the huge silver deposit known as the Potosi. Spanish adventurers extracted millions upon millions of dollars' worth of silver from these prodigiously rich ores.

And Silver Helped Cause the Carthaginian War!

Silver has been known and used by man since pre-historic times. It is mentioned in the Chinese classics, dating from 2500 B.C. Herodotus the Greek historian says: "So far as we know the Lydians were the first to make coins of gold and silver." The silver mines of Laurium, in Attica, are famous in Greek history; and those in Spain, of a later date, are even better known. In part it was Rome's jealousy of Carthage for the possession of these Spanish ore deposits that brought on the first Punic War and started Carthage toward her fall. The Greeks and Romans used a metal called "electrum," 20 per cent gold and 80 per cent silver, for wine goblets, because it was popularly believed to possess the property of betraying the presence of poison.

Silver is the most malleable of metals, with the exception of gold, and is next to platinum in ductility. One ounce of silver can be drawn out into a wire more than three miles long, and silver leaf can be beaten to a thickness of one ten-thousandth of an inch. Silver is the most perfect conductor of electricity known, but it is far too costly to be used extensively for this purpose. Silver melts at 1,000° Centigrade, and volatilizes or forms gas at higher temperatures. This gas is a pale blue vapor which absorbs large quantities of oxygen. As it cools and becomes solid again, it expels the oxygen with great violence—a curious phenomenon known as "spitting silver."

Use of Silver in the Industries

About one-third of the world's annual production of silver is made into coin; the remainder is used for industrial purposes. Silver is highly prized for toilet articles and jewelry throughout the world, and the profession of the silversmith has been an honored one for centuries. Many ornaments used in churches are of silver. In Europe and America table-ware is made of solid or plated silver. Silver forms useful alloys with almost all metals, but chiefly with gold and copper. It combines also most readily with sulphur, forming the black silver sulphide so often seen on spoons and forks which have been in contact with the yolks of eggs. Silver is the chief component of one of the most dangerous explosives known, called silver fulminate. When dry, this compound explodes with terrific violence, even on touching it with a feather.

Silver compounded with chlorine, and more often with bromine, forms those strange chemical salts which are sensitive to light and are therefore used in photography. The image in a photograph is composed of deposits of pure metallic silver in the gelatine coating. (*See* Photography.)

Various compounds of silver are used in medicine and surgery. The most important of these is silver nitrate or "lunar caustic," a powerful antiseptic with healing properties. Internally certain silver chemicals are used for gastric disorders and dysentery, but taken in large quantities they are dangerous poisons.

Wounds are sometimes sewed together with silver wire and broken bones bound with silver bands. Fractured parts of the skull sometimes are replaced with silver plates. This metal is also used extensively in the manufacture of surgical instruments.

Silver is mined principally in the United States, Mexico, South America, Germany, Austria, Canada, Spain, and Australia. It is often found associated with copper and lead, and much of the world's supply is obtained as a by-product in smelting these metals. Indeed, unless a rich deposit is found, the mining of silver for itself alone does not often prove profitable. The silver mines of Cobalt, Ontario, are relatively shallow. The ore here is perhaps the richest known in the world today, in places running as high as 200 pounds of pure silver to the ton. In the Cobalt region, much of the silver occurs in metallic form.

Nevada, Montana, Utah, and Idaho are the leading states in silver production in the United States. (*See also* Mines and Mining; Money.)

SIMS, VICE-ADMIRAL WILLIAM SOWDEN (born 1858). One fair morning in May 1917, soon after the United States entered the World War, the Stars and Stripes rose slowly to the top of a British mast, and for the first time in history a considerable portion of His Majesty's navy was under the command of an American officer. The man upon whom this unique distinction was bestowed was Vice-Admiral Sims. The occasion was an emergency in the Irish Sea which called for a combined fleet of British and American ships.

ADMIRAL SIMS

When the United States declared war against Germany, Sims, then Rear-Admiral and president of the Naval War College at Newport, was put in command of American naval operations in European waters. No one was better fitted to assume this huge task. When a young man, on duty in China, he met an English officer, Captain (later Rear-Admiral) Percy Scott, whose ship was making remarkable records at target practice by using a device of Scott's. After much study Sims became convinced that American gunnery was dangerously inefficient and he urged the adoption of the new methods upon the Navy Department. Getting no response from that quarter, he wrote directly to President Roosevelt. In reply he was ordered home, where he conclusively proved his contention. Entire charge of the navy's gunnery was assigned to him and seven years later American gunners were the most expert in the world. Then in 1907 he opened the nation's eyes to many grave faults in the design of American battleships. After a heated controversy the faults were eliminated in all subsequent ships, and thanks to this and to several new ideas evolved by the Navy Department, American dreadnoughts are among the best in the world.

And what would you guess is the favorite pastime of so distinguished a naval officer? It is writing limericks!

Admiral Sims was born in Port Hope, Canada, but his parents subsequently removed to the United States. He was educated in the United States Naval Academy at Annapolis (1876–80), to which he was appointed from Pennsylvania.

SINGAPORE (*sĭng-ä-pōr'*). Through the needle's eye of Malacca Strait is threaded the great trading route to the Far East, controlled at the tip of the Malay Peninsula by the island city of Singapore, midway between India and China. In Singapore harbor lie great and small ocean liners, long lines of Chinese coaling-ships, Malay sampans with split-tail sterns and painted eyes on the bow, and curious Chinese sailing craft—an aggregate shipping of 17,000,000 tons yearly. From some of the emerald islands sprinkled over the pale green sea stare bristling rows of big guns—for the "Liverpool of the East" is not only the chief commercial center of southern Asia and one of the most valuable of British minor possessions, but a naval base of great strategic importance in the Orient.

A splendid European hotel faces the sea; parks, clubs, and polo and cricket grounds reconcile European residents to the sultry climate of latitude 1° 20′ N.; but the narrow streets of the native quarter swarm with bobbing rickshaws, tall red-bearded Arabs, Bombay merchants, shrewd Chinamen, and "blacks" from the mainland. More than half of Singapore's population is Chinese, but there is scarcely a color, creed, caste, or nationality unrepresented in the cosmopolitan swarm. Red roads, on which all day long hungry-looking black Tamils sprinkle water from a pig-skin, gash the deep green of the thick shrubbery, luxuriant in the humid heat—for all seasons are wet in Singapore; there are 182 rainy days in an average year. The highest of the island's hills is called the Tin-hill, for Singapore lies in the region from which one-third of the world's tin comes, and tin-smelting is the chief industry in this busy tropical city.

Singapore island is 27 miles long by 14 broad. The town is the seat of government for the British crown colony known as the Straits Settlements. Population, more than 300,000.

SIPHON. If you fill a rubber tube with water, pinch the two ends to keep the water from escaping, put one end in a bucket of water on the table and the other in an empty bucket on the floor below, then release the ends, the water will flow up through the tube as it curves over the rim of the upper bucket and then down through the tube into the lower bucket. Such a contrivance is called a siphon.

Gravity is pulling down on the water in both limbs of the tube, yet it flows up one side and down the other. Why? Atmospheric pressure does the trick—atmospheric pressure plus the difference in the weight of the two columns of water in the tube. When the water flows out of the lower end, atmospheric pressure on the water in the upper pail pushes it up to fill the vacuum that would otherwise occur at the top of the bend. The siphon will not raise water more than about 33 feet, because then the weight of the water equals the atmospheric pressure.

Siphons on a large scale are used in aqueducts to carry water across hills. The so-called "siphons" of charged water are not true siphons, for the water is forced out by the pressure of the gas.

Sisal (*sĭs'ăl*). There is one time when every American farmer takes an interest in the internal affairs of Mexico and the Central American republics. That is when one of their frequent civil wars threatens to cut off the thousands of tons of sisal fiber that go into the binder twine for his grain crops. Yucatan is the original home of the sisal plant and the chief place where it is cultivated, although some of the supply now comes from other portions of Central America, Mexico, Hawaii, and West Indies.

The sisal plant is a perennial growing for a period of 8 to 25 years. The fiber is yellowish-white, lustrous, strong, and pliable, and among the cordage fibers it is only excelled by the long smooth fiber of Manila hemp. It is a relative of the century plant, which it closely resembles. The swordlike leaves, which spring straight and stiff from the base of the plant, are from three to five feet long and as wide and thick as a man's hand. They are not ready to cut until about the fifth year of their growth, and then only the bottom rows of mature leaves are cut each year. About 12 to 20 leaves are taken from a plant at one cutting, to furnish about a pound of fiber. The leaves are cut with a sharp knife, tied in bundles, and hauled to a central plant where machines crush and pound them and scrape away the pulp. The clean fiber is taken from the machine and hung up to dry, after which it is baled for shipment.

At maturity the sisal plant sends up a flower stalk, 10 to 20 feet high, bearing dense flower clusters on a branching head. The flowers are followed by small plants or bulbils, instead of seeds, which are cast on the ground to propagate new plants, and then the parent plant dies. Fresh sprouts start from the dead stem of the old plant and new plantations are obtained by setting out either the sprouts or the bulbils.

The sisal plant requires a continuous warm dry climate, and is injured by frost. It needs little care except for the cutting down of vegetation between the plant rows once or twice a year. Mexico has a sisal plant known as *henequen*. Scientific name of true sisal, *Agave sisalana;* of Mexican sisal, *Agave fourcroydes*.

Sisyphus (*sĭs'ĭ-fŭs*). For his craft and exceeding wickedness, Sisyphus, founder and king of Corinth, was doomed, according to Greek legend, to one of the bitterest punishments of the lower world. He was condemned to roll a large stone up a hill which, when it reached the top, fell over back again, so that his wearying task was never ended. Dante in his great poem, the 'Inferno', represents Sisyphus toiling ceaselessly throughout the ages at his hopeless task.

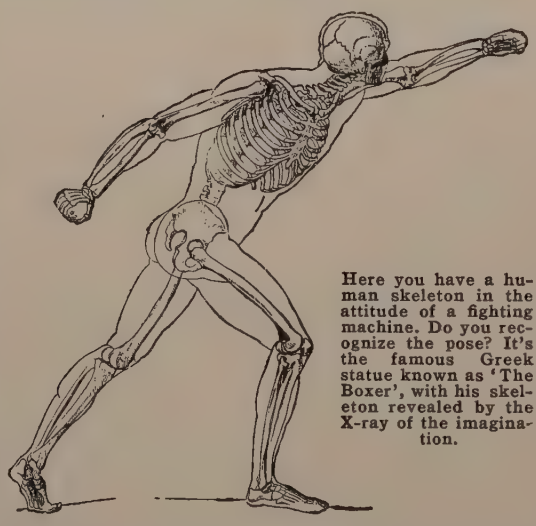
Skates or **Rays.** Thirty or more varieties of these strange fishes are found in the Atlantic and Pacific oceans, each variety more villainous in appearance than the next. They are quite properly called "sea-devils," for they look more like monsters seen in a nightmare than proper inhabitants of the sea. They are close relatives of the sharks, though so different in shape and appearance. All species of skates are more or less flat and triangular in shape, with a long thin tail, often equipped with a barbed spine, with which they can inflict painful and sometimes dangerous wounds. Their peculiar shape is due to the expansion of their front fins into broad flaps of flesh, with which they make their way awkwardly through the water. Some "sea-devils" are enormous, reaching 15 feet in width, and weighing 1,000 pounds.

Skates usually live on the sandy bottom of the ocean not far from shore. Their eggs have an oblong tough shell from three to eight inches long, with a streamer at each corner.

Scientific name of common skate, *Raia batis;* of sting-ray, *Myliobatis californicus*.

Skeleton. When we build an engine we always start with a rigid framework to which the moving parts are fastened. The more powerful we make our engine, the stronger and more solid must be the foundation. It is the same with the living engines of the animal world. They need a framework to support their lung-carburetors, their heart-valves, and their stomach-cylinders; and they must have a foundation from which their arm-pistons and walking-beams can be thrust out. This framework and foundation is called the "skeleton."

THE MARVELOUS FRAMEWORK OF THE BODY

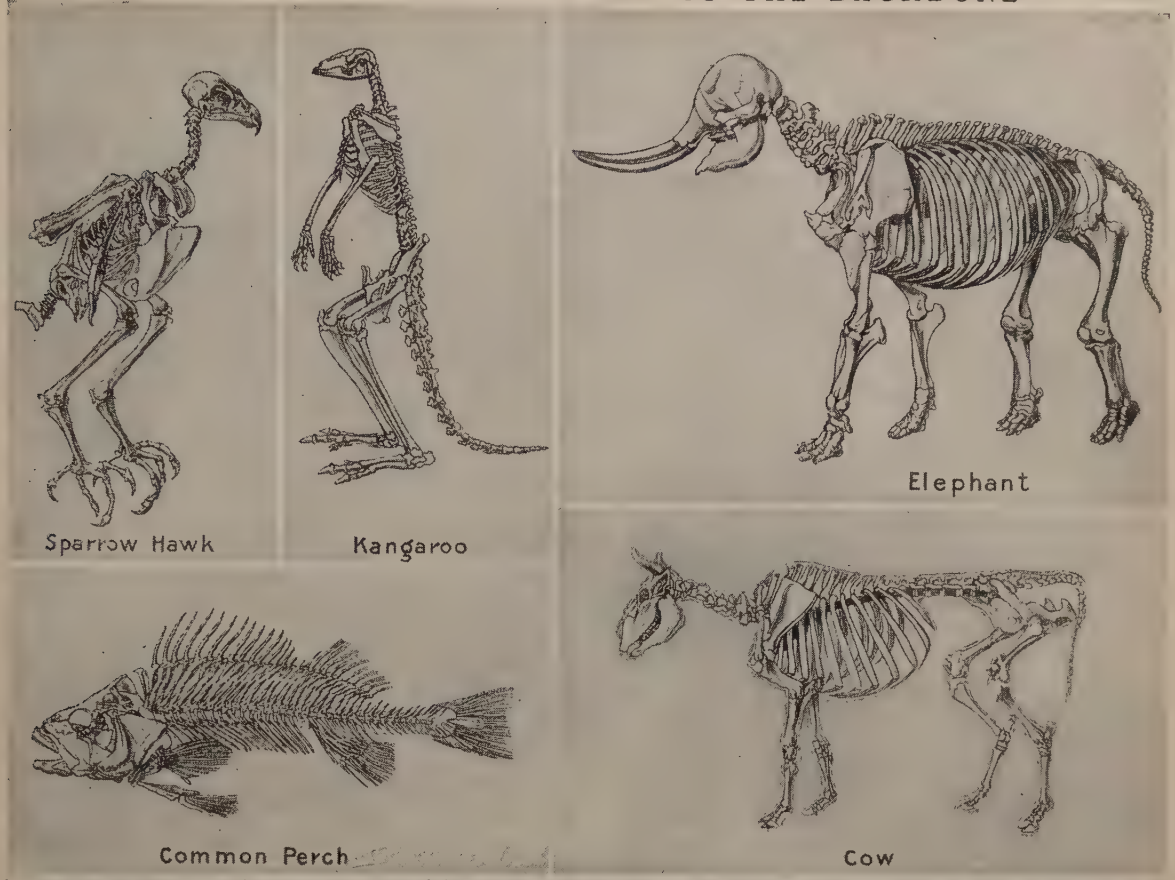


Here you have a human skeleton in the attitude of a fighting machine. Do you recognize the pose? It's the famous Greek statue known as 'The Boxer', with his skeleton revealed by the X-ray of the imagination.

Some animals, like the lobster and the crab, the oyster and the beetle, wear their skeletons on the outside. Water creatures, as a rule, don't need such a strong framework, for they are surrounded and supported on all sides by the water in which they live. Some, like the octopus and cuttlefish, get along with nothing but one gristly or chalky bone, but they are usually slow and helpless on land.

In fact, so essential is the skeleton to active versatile life that the higher forms of animals are classified as *vertebrates*—that is, creatures with backbones. Of these, man is the highest, and has, therefore, the most highly developed skeleton.

THE GREAT BROTHERHOOD OF THE BACKBONE



"Nature," says Emerson, "plays one tune to infinite variations." Here we see illustrations of the many "tunes" that she has played on the idea of the backbone. To the backbone of the Sparrow Hawk she attached wings and so made a bird of the air. In the picture of the Kangaroo, note the relative size of the front and hind legs. Even if we had never seen a Kangaroo, the skeleton would tell us that it did not walk on all fours. The Elephant and the Cow have a somewhat similar anatomy, since they are both mammals, and a similar cumbrous dragging gait. But the Perch might say: "We fish are the grandfathers of them all"; for Nature's great discovery of the backbone was made in the life of the water.

The human skeleton is composed of about 200 bones, each adapted to its place and duty. The foundation of our body structure is the "backbone" or spinal column, which is really composed of 24 separate bones called "vertebrae." There is a pad of cartilage between each two vertebrae, forming an elastic cushion and permitting a slight motion. The skull is set on top of the vertebral column. About 20 bones form the skull, there being more in early life than later, some of the parts uniting gradually as life advances. Twenty-four ribs, 12 on each side, bound the chest; most of these are connected by cartilage to the breastbone. The "shoulder girdle," consisting of the shoulder-blade and collar-bone, supports the arm. At the lower end of the backbone is the "pelvis," a strong bony ring composed in the young of six separate bones, but later uniting to form only two. To the pelvis the legs are attached.

The bones of the skeleton are held together by strong bands of connective tissue called ligaments. It is the tearing out of ligaments that constitutes the essential injury of a bad sprain.

The skeleton made up of its separate bones with their numerous hinges or joints, their cartilaginous cushions, and their tough ligaments constitutes a wonderfully adjustable, elastic, strong, and protective foundation for all the organs. The muscles in large part are attached to the bones across the joints, so that movements are brought about by the shortening or contraction of the muscles. The vital organs are well protected in bony cavities like the cranium, chest, and pelvis.

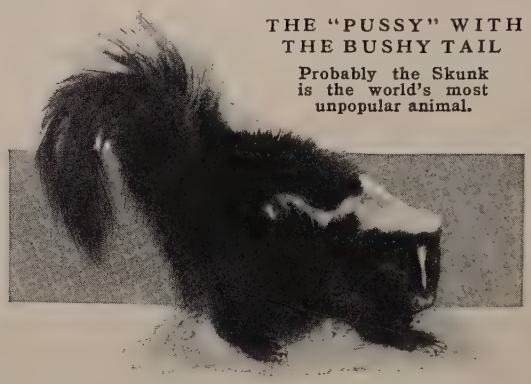
In the young the number of bones is larger, the proportion of cartilage greater, and the percentage of mineral matter less. Hence they can stand falls and bumps that would be likely to break the bones of an old person.

SKIN. Human skin is composed of two main layers, the "epidermis" or scarf skin outside, and the "dermis" or true skin underneath. The true skin is studded and ridged with tiny projections above; the scarf skin is correspondingly pitted and furrowed underneath; and the two fit together like the parts of a puzzle. On the palms of the hand and the soles of

the feet these ridges become so prominent that the upper surface of the epidermis is ridged and furrowed in patterns of tiny whorls and loops which are unique for each individual, so that each person's finger-print is an authentic "sign-manual," better than any written signature (*see* Finger-Prints).

We speak of "thick-skinned" and "thin-skinned" people, but all of us are comparatively thin-skinned over certain parts of the body (about 0.5 of a millimeter or $\frac{1}{50}$ of an inch on the eyelids, for instance), and thick-skinned over others (4 millimeters—about $\frac{1}{6}$ of an inch—or more over the palms and soles). The skin is thicker over the back than in front, and on the outer than on the inner sides of limbs.

The outer layers of the epidermis are constantly drying up, flaking off, and being renewed from below—imperceptibly as a rule, though we notice the loss and replacement when the skin is blistered or otherwise injured. The deeper epidermis layers contain the pigment that makes an Indian brownish-red, a Chinese yellow, and a negro black. The pink of a fair or florid complexion is due to the red blood circulating under a more or less colorless and translucent skin. Finger-nails and toe-nails, like the claws and hoofs of the lower animals, and the hollow horns of the ruminants, are merely thickened and hardened epidermis. Hair, too, is modified epidermis (*see* Hair).



THE "PUSSY" WITH THE BUSHY TAIL

Probably the Skunk is the world's most unpopular animal.

Two sets of glands pour their secretions over the skin. The flask-shaped sebaceous glands, situated deep in the true skin and usually associated with the hairs, occur practically all over the body except on the palms and soles. In health their oily semi-fluid secretion lubricates the skin and hair. Sometimes it hardens within the duct, forming a plug or "blackhead" which has to be pressed out. The sweat glands are set deeper yet and reach the surface through crooked ducts, twisted like a corkscrew where the outer epidermis is thick and horny. They are scattered all over the body, being most numerous in the places from which the sebaceous glands are absent, the palms and soles. There are estimated to be nearly 3,000 sweat glands to the square inch in the palms—more than six times as many as in the skin of the back. Their secretion, the perspiration, is essentially water.

The skin serves a threefold purpose: (1) Tough, resistant, flexible, and elastic, it protects the delicate body tissues against injuries, being especially thick, hard, and cushioned with fat where it is subject to constant knocks and pressure, as on the soles, and more delicate and elastic over the joints. (2) Much news of the outside world reaches us in the form of sensations of touch, heat and cold, pain, etc., through the special sense organs in the skin. Many of the tiny protuberances (called "papillae") on the upper surface of the dermis contain nerve-endings; these "tactile papillae" are especially numerous over the soles and palms. (*See* Touch.) (3) Perhaps the most important function of the skin is the regulation of the body temperature. It keeps in the body heat, and also, when necessary, reduces the temperature through the evaporation of the perspiration. In summer the sweat glands are more active than in winter, so as to keep the body temperature normal in a heated atmosphere. The quantity of water thrown off by the skin depends also on the amount of water taken into the body and the physical exercise taken.

Baths, generally speaking, improve the condition of the skin, aid the action of the glands, and reduce heat.

SKUNK. Many a story is told of persons who have ignorantly or carelessly disturbed one of the "pretty pussies" and then have had to "bury their clothes" to get rid of the horrible odor! There are several species, all found only in the New World. The common skunk is about the size of a small cat, and ranges from Hudson Bay to Guatemala. The body is rather stout, the tail very bushy, and the prevailing colors black and white. It usually is black, with broad stripes of white running lengthwise.

Skunks burrow and are most active at night. They feed on insects, mice, salamanders, frogs, and eggs of birds that nest low. Sometimes they rob hens' nests, but this is by no means the rule. On the other hand, they benefit the farmer by destroying a large number of beetles, grasshoppers, and field mice.

Ordinarily they do not run at the approach of man, but, conscious of the protection of their evil-smelling secretion, move away deliberately. They can eject this fluid at will to a distance of 8 or 12 feet. Daring persons sometimes succeed in taming them so that they may be stroked and petted without ill results. Skunks often come close to camps and outlying dwellings, and a pair may even take up their abode under barn or porch. The flesh is said to be white and sweet. The fur of the skunk is now extensively used and is quite valuable. It sometimes goes under the name of "Alaska sable." Special treatment relieves the fur of all unpleasant odor.

The term "polecat," which is sometimes applied to the skunk, really belongs to a related animal of Europe and Asia, whose fur is dark brown above and black below.

Scientific name of the common skunk, *Mephitis mephitica;* of the European polecat, *Putorius foetidus.* Both names refer to the sickening odor.

SLANDER

"TO speak no slander; no, nor listen to it," was one of the rules of King Arthur's Round Table. It is one of the rules of every gentleman and every gentlewoman; it is one of the rules of every good American.

"Thou shalt not bear false witness" is a solemn command which has come thundering down almost from the dawn of civilization. Slander is false witness. Today, when every man is truly your neighbor, when news travels on the wings of the lightning, that command means even more than it did in those days of old when first it was written on the tablets of stone.

The idea that slander is a poison is as old as literature. Juvenal called it "that worst of all poisons," and St. Bernard wrote:

> Slander is a poison which extinguishes charity, both in the slanderer and in the person who listens to it; so that a single calumny may prove fatal to an infinite number of souls, since it kills not only those who circulate it, but also those who do not reject it.

It was in the same spirit that Shakespeare wrote his stinging lines:

> 'Tis slander
> Whose edge is sharper than the sword, whose tongue
> Outvenoms all the worms of Nile, whose breath
> Rides on the posting winds, and doth belie
> All corners of the world.

It is a theft as well as a poison, for it robs people of their highest treasure—their good reputation. Iago says to Othello:

> Good name in man or woman, dear my lord,
> Is the immediate jewel of their souls;
> Who steals my purse steals trash; 'tis something, nothing; 'twas mine, 'tis his, and has been slave to thousands;
> But he that filches from me my good name
> Robs me of that which not enriches him
> And makes me poor indeed.

More often than not the slander that injures a man, and may bring about his ruin, begins in gossip, the gossip that comes, perhaps, from nothing worse at first than idleness. It is one of the greatest evils in the world, but it springs, as a rule, from ignorance.

We find it chiefly among those who have very little to do, and have no particular object in life, the sort of people of whom the old poet was thinking when he wrote:

> I slept beneath the moon,
> I basked beneath the sun,
> I lived a life of going-to-do,
> And died with nothing done.

We may be sure that people to whom these lines apply are great gossips. They will talk about anything, but generally about things of which they know nothing. They will talk from morning to night, at street corners, and on doorsteps, in a shop or in a drawing-room. Many a man and woman they have ruined with their talk; for, nonsense though it mostly is, the strength that can ignore it is not common. The strong man can laugh at all the silly talk of silly people; but even he may be brought down by it at last, ruined in business, or driven from public life, or shunned by a world which is too busy to inquire, but shrugs its shoulders and whispers that "there must be something in it, or people would not say these things."

The danger of exaggerated talk besets us all. It is so easy to add a little to something we have heard, and a little added here and a little added there will turn harmless gossip into cruel slander, and truth into a lie.

We must be honest in things that we repeat, and careful in all that we say. If our own eyes and ears deceive us at times, as we know they do, we may be sure that truth loses much in coming through a dozen eyes and ears. If a thing sounds false, let us believe it false until we find it true, and let us think good of all until we find them unworthy.

CALUMNY

A whisper woke the air,
A soft, light tone, and low,
Yet barbed with shame and woe.
Ah! might it only perish there,
Nor further go.

But no! a quick and eager ear
Caught up the little, meaning sound;
Another voice has breathed it clear,
And so it wandered round
From ear to lip, from lip to ear,
Until it reached a gentle heart
That throbbed from all the world apart
And that—it broke.

It was the only heart it found—
The only heart 'twas meant to find,
When first its accents woke.
It reached that gentle heart at last,
And that—it broke!

FRANCES SARGENT OSGOOD

Slang. There is a "vagabond language"—wild, free, racy, often vulgar—which refuses to follow the usual standards established by the best writers and speakers. We call it slang.

At its worst the use of slang tends to vulgarize one's speech, to limit one's vocabulary by driving out the more reputable words. It leads one to look for expressions that are in themselves striking or "different," rather than those which convey the exact shade of meaning. The slangy person whose adjectives are limited to "rotten," "bully," "swell," and "stunning" finds himself at a loss when he attempts to describe a thing accurately.

The Spice of the Language

At its best, slang lends spice to language. It is often forcible, vigorous, and picturesque. Slang expressions are sometimes homely but effective figures of speech (*see* Figures of Speech). Most slang expressions are short-lived; but in every age there are some of these vagabond words which are, as it were, admitted into respectable society and become part of the standard language. Had our forefathers never used slang, our language would be much poorer. "Blizzard," "skyscraper," "mob," "humbug," and "banter," were originally slang expressions. "Squelch" was found to be so convenient and expressive a word that it has recently been admitted into good usage, and perhaps in the same way our word "swat," which the anti-fly campaign has made so popular, will some day appear in our dictionaries without the notation "slang." So "bluff" (to deceive by a confident manner), "graft," and "knock-out" are well on the road to respectability.

Originally regarded as the language of the criminal and vagrant classes and often springing from their jargon or *argot* as the French call it, slang has invaded almost every walk of life and almost every class or profession has its own expressions. The college student speaks of "boning" or "bucking" or "cramming" for an "exam." The actor waits to "see the ghost walk" (get his salary). The theatrical manager hopes the play will "register" or "get across" to the public. The artist complains that his picture has been "skied" (hung too high in an exhibition). The business man looks for a "slump in the market" if the "bears" triumph over the "bulls." The politician calls those who belong to no party "mugwumps."

New Words out of War Times

The World War brought into use a large number of new words, among which were not only many technical terms, but a great many vigorous slang expressions. "Doughboy," "Tommy," "poilu," and "boche" or "Heinies" and "Fritzes" were the terms adopted for the American, British, French, and German soldiers, respectively. "Gob" was the most popular name in the American navy for a "jackie" or enlisted man. The title "ace" was given to an aviator who had brought down five or more enemy planes. "Blighty" was the British soldier's term for home; to "go west" his figurative expression for death.

Slate. School "slates" and the queer slate tombstones of colonial New England belong to a past day. But the dark gray (sometimes blue, greenish, purplish, or even red) stone from which they were made is still widely used for roofing, sinks, washtubs, flooring, blackboards, mantels, etc. For all these uses slate is especially suitable because of its smooth easily cleaned surface, and its property of splitting into thin slabs or leaves.

Slate is, in scientific terms, a metamorphic aqueous rock. It was first deposited by water as a bed of clay. If such clay becomes structureless stone by the mere removal of uncombined water, it is mudstone; if, having been deposited in layers, it has a tendency to split along the bedding planes, it is shale; but if—perhaps having first been tilted up at a new angle—it has then been compressed by tremendous force, so as to spread it out and produce cleavage planes at right angles to the direction of pressure, it becomes slate. This tendency to split into thin slabs is so characteristic of slate that the name is sometimes applied to shale and almost any rock which splits in this manner—as anthracite slates, whet slates, and talc slates.

Slate has not a wide geographic distribution. Most of the slate used in the United States is quarried in Pennsylvania, Vermont, Maine, Virginia, Maryland, New York, and Georgia. Most European slate comes from Wales and France.

Slavery and Serfdom. Go back as far as we may to the beginnings of history, we find the slave in all countries. We see him in Egypt toiling to build the pyramids; we meet him in Babylon; we find on the clay tablets in Assyria that a man and a camel alike sold for half a shekel of silver; and early in Jewish history we see Joseph being taken from the pit and sold by his brothers. For more than a thousand years slavery held sway in Greece and Rome. Athens was founded upon it, although she gloried in the principle of freedom; and even Aristotle, her greatest philosopher, accepted slavery as a necessity. In Rome the victorious conquerors brought home thousands of captives to serve in the houses and on the estates of the wealthy, one man sometimes owning hundreds or even thousands of slaves.

Slavery began even before man gave up his wandering pastoral life and settled down to till the soil. As an act of mercy the vanquished of the battlefield, with their wives and children, were made slaves rather than put to death. Sometimes men became slaves through inability to pay their debts; others were reduced to slavery by judicial sentence; among the ancient Germans men at times gambled away their freedom at games of chance. In times of peace, when captives were few, a slave trade was set up which dealt in slaves of many nationalities and all ranks; often a slave might be of higher birth and education than his master. Greeks enslaved Greeks, and were in turn made to serve the Romans, who often used such slaves to tutor their children. Count-

less captives were brought to Rome from Carthage, Spain, Gaul, and Asia Minor. In Athens slaves were usually treated kindly; but under Roman rule brutal treatment was sanctioned by both law and custom, especially on the great estates, so that the slaves at times revolted against their masters.

After the barbarian invasions of the 5th and 6th centuries A.D., chattel slavery (as it was called) gradually died out. In its place arose a new institution—the serfdom of the Middle Ages. The serf was not the chattel or "thing" of his master; he was a person, although of inferior rank. Like the free peasant (villein), the serf held and tilled a few scattered acres of land from the lord of the manor, for which he paid various dues and rendered two or three days' work a week on the land which the lord kept in his own hand. But unlike the free peasant, the person of the serf was unfree. He was "bound to the soil" and could not leave his master's estate; if he fled, he could be brought back, unless he found refuge "for a year and a day" in some chartered town. In the payment of dues, in regulations concerning marriage, and in rights of inheritance, there were distinctions which marked the serf as an "unfree" person. In England serfdom died out soon after the great Peasant Revolt of 1381, but in certain parts of France it lasted to the French Revolution. In Prussian Germany serfs were not freed until the beginning of the 19th century; and in Russia the great step which emancipated 40,000,000 serfs by imperial edict was not taken until 1861.

The Revival of Slavery

Slavery revived somewhat in Europe, especially in the 15th century, when the Portuguese began to introduce African slaves taken by the expeditions which they were slowly pushing down the west African coast. In the New World, the institution was revived with all its ancient horrors, to work the mines and till some tropical lands. At first the Spaniards tried to enslave the Indians; but they were not suited to such labor, and gradually dwindled in numbers under the unwholesome conditions until whole tribes disappeared. Negro slaves were then imported from Africa in increasing numbers to take the place of the Indians. The blacks proved equal to the tasks. They were accustomed to the hot sun, and became docile under cruel treatment. From the West Indies slavery passed to the mainland, the first shipload of slaves being landed in Virginia in 1619; and in course of time slave labor was considered indispensable on the great tobacco, sugar-cane, and cotton plantations throughout the South.

Guilty of nothing but "a skin not colored like our own," millions of Africans were torn from their homes, and European ship-owners vied with one another for the privilege of trading in these "cargoes of despair." But the sufferings caused by the loathsome traffic finally aroused the indignation of all thinking people. In the famous case of the negro Somerset, the courts of England decided that as soon as a slave set foot on the soil of the British Isles he thereby became free. The Quakers had long "borne witness" against slavery; English philanthropists such as Clarkson and others had written, spoken, and agitated against the slave trade; and the authors of the French Revolution had taken a firm stand in favor of the freedom of all men. Denmark took the lead in abolishing the slave trade in 1792; England followed in 1807; and in the same year the United States prohibited the importation of slaves into its dominions—that being the earliest date under the compromises of the Constitution at which such action could be taken. In 1815 the traffic received its final blow in the Council of Vienna, when, through England's efforts, all the powers represented agreed to abolish it.

Europe Leads the Way

The evils of slavery, however, could be ended only with abolition. Agitation toward this end was carried on in England by William Wilberforce, who devoted 50 years of his life to the cause, taking every opportunity in the House of Commons and elsewhere to expose the evils of the system. In 1833, a month after his death, a bill was passed providing for the emancipation of all slaves in the British colonies, and appropriating a sum of about $100,000,000 compensation to the owners. Great Britain thus won the distinction of being the first great modern nation to take such a step. Its example was gradually followed by the other European states. The United States remained for some years the only important nation which still clung to slavery.

In the United States the struggle between the slave and free states was long and bitter. Stirred by 'Uncle Tom's Cabin' and other anti-slavery literature, people of the Northern states did all they could to aid negro slaves to escape. In defiance of the stringent fugitive slave laws, which required that all escaped slaves should be returned to their owners, groups of prominent men organized the "underground railroad." Slaves who crossed the Mason and Dixon line were directed to trusted families who gave them food and shelter, and at night directed them to the next station on the line. This practice, which aided about 25,000 slaves to escape to Canada, was one of the grievances of the South against the North. When the Civil War finally came, President Lincoln in 1863 issued his famous Emancipation Proclamation; and in 1865 the 13th constitutional amendment prohibited slavery in the United States forever. (*See* Civil War and Reconstruction.)

The Evils of Peonage

In Spanish America, particularly in Mexico, where slavery was early forbidden by the Spanish government, a form of agricultural servitude of the Indians was established known as "peonage." Though now prohibited by law, the poorer people are still sometimes lured into debt by their employers and then kept as "peons," the law permitting this forced labor until their debts have been paid. At times since the

Civil War it has been charged that conditions similar to peonage have existed among the negro agricultural population of certain parts of the South.

Although prohibited, the slave trade is said to exist still to some extent in the Congo and Portuguese West Africa, as it does among savage tribes in other parts of the world. Mohammedan household slavery is also said to continue in spite of official prohibition.

Slavs (*slävz*). The Slavic peoples bear a numerical relation to the Teutonic, Latin, and Celtic peoples somewhat like that which the huge solid bulk of Eastern Europe bears to the fringed and attenuated lands of the West. Estimates of the total number of the Slavs vary from 140,000,000 to 172,000,000, and the recent inroads of war, famine, and disease make all reckoning uncertain. Yet the Slavs far outnumber any other European racial division, as judged by the language test, without counting their emigrated members in Asia and America.

The Slavs are a generally broad-headed (brachycephalic) race, sometimes fair, though never so fair as the typical blond Teuton, and sometimes dark. The type, however, has been blurred by many racial crossings. Their name has been derived by an oft-disputed etymology, from a root meaning "glory," which appears in many Slavic names (for instance, Ekaterinoslav, "glory of Catherine"); and it is said—and likewise disputed—that our word "slave" comes from the many Slavic captives once sold in the slave-markets of Europe by their conquerors.

When the Slavs first emerged from obscurity, in the early centuries of the Christian era, their tribes were found northeast of the Carpathians, between the Oder and the Dnieper rivers. They were members of the great Aryan or Indo-European family of peoples and their nearest relatives are the Baltic Prussians, Lithuanians, and Letts. From this original center, they spread in all directions—pushed back on the north and west by Baltic and Teutonic tribes, overrun by successive invasions from Asia, and churned by migration and conflict into many separate nationalities. Some of these groups—as the Wends, Slovaks, Slovenians, Bohemians (Czechs), Moravians, Croatians, Bosniaks, and Dalmatians—while preserving a certain degree of individuality as peoples, became all but effaced politically through conquest, dynastic marriages, or voluntary acceptance of foreign rulers. The Poles, the most individualist and masterful of all the Slavic nations, declined in power through their turbulent and undisciplined aristocracy, and were dismembered in three great partitions at the close of the 18th century (*see* Poland). The vast empire of Russia, formed about the grand duchy of Muscovy, became one of the "six great powers" of the times just past. It included the Great Russians, Little Russians (Ukrainians or Ruthenians), White Russians, and the chief block of the submerged Poles. The Ukrainians probably diverge least from the primitive Slav type. Serbia, Bulgaria, and Montenegro had to battle for existence against the Turks since the 14th century; while Montenegro successfully resisted Ottoman conquest, the two former obtained their independence of the Turks only in the 19th century.

The eastern Slavs of Russia and, in the main, the southern Slavs of the Balkan peninsula, adhere to the Greek Catholic (Orthodox) church, and use the Cyrillic alphabet, a modified form of the Greek alphabet. The western Slavs—the Croats, Poles, and Bohemians, especially—were christianized from Rome and still adhere to the Roman Catholic church and use the Latin alphabet.

The Slavic peoples have never played a part in European history in keeping with their numbers and possibilities. In a sense they are the backward nations of Europe, politically and industrially retarded, partly by their own characteristics and partly by unfavorable circumstances. Brave and brilliant, the military Slavic nations were too jealously individualistic to submit to discipline and learn the value of union. The eastern and western Slavs, divided by religion, exhausted much of their energy in fighting against each other. The geographic position of the Slavic nations was also unfavorable, for it made them the great breakwater of Europe against Asiatic conquest. Successive waves of Avars, Huns, Magyars, Mongols, Tatars, and Turks again and again submerged the beginnings of Slavic culture, and receding left pools of alien population to muddy the Slavic streams into which they were absorbed.

But the Slavs have special gifts in literature and art—witness the great names of Turgenief and Tolstoy in literature; of Chopin, Dvořák, and Tschaikovsky in music; of Makovsky, Vereshtchagin, and Mucha in painting. Their character is widely different from that of other European peoples; the novelist Dostoyefsky complains that Russians are misconstrued at every turn.

The future condition of Russia, the fate of the resurrected commonwealth of Poland, and of the new states of Jugo-Slavia, Czecho-Slovakia, and Ukrainia, time alone can reveal. Their peoples clearly have not as yet been permitted to develop their own special contribution to the progress of civilization. Can it be that today we are at the Slavic dawn, as the break-up of the ancient Roman empire was the Teutonic dawn?

Sleep. "Where was I when I was asleep, Mother?" This is the question little Robert asked his mother. "Why, right here in bed," she replied, "I watched you all the time."

This answer was true enough; but it did not entirely satisfy Robert, for he wanted to know what happened to him when he was asleep, and why he knew nothing and remembered nothing, and why the time seemed so short during the long hours of the night.

During the day of play and work Robert got tired. He used up the substances of his body faster than they could be repaired. This was true not only for his muscles by which all his movements were carried on, but also for his brain which directed his motions and

received all the time the impressions which came from his eyes, ears, and other sense organs. The brain especially needed to be repaired, for without it all the rest of the body would be of little account. So the thinking machine stopped work. That is sleep.

The brain is a great switchboard by which nerve impulses are shunted in proper relation and the results of many of them stored up to form the basis of memory (*see* Brain). In sleep many of these connections are less close. Impulses cannot pass so readily. Thus the whole structure gets a chance to rest.

What Dreams are Made Of

A strong sensory impulse may still be able to break in and set the machine going. For example, a loud noise or a strong shake may wake one up. If a person eats too much of the wrong food, especially for supper, he has indigestion; and the nerves from the stomach may be stimulated and send strong impulses to the brain. Under such circumstances Robert's sleep is likely to be poor, and he may have bad dreams.

Dreams are due to the fact that certain regions of the brain are not resting. Impulses are passing in partial areas, just as one might imagine part of the central telephone exchange of a great city to be active, while most of it was shut down. Under such circumstances the intelligent distribution and understanding of news would be interfered with.

So it is in dreams. There are no actual sensations for comparison. "Common sense" is off duty. The memory connections are made in an irregular manner. Usually there are no open pathways to the muscles for accomplishing motions. The result is that dreams are unreal and often deal with impossibilities. They are like our imaginings and ideas when awake, except that they are not kept in order.

Sometimes in some persons the nerve switches to the muscles are open in sleep. Such people (whom we call "somnambulists" or "sleep-walkers") may walk or do other things in their sleep and afterward know nothing about it, because the knowing part of their brain was disconnected.

Thus you see the brain may be more or less active. It may act in parts. So also sleep may be more or less sound. It is soundest for the first hour or two. After that the soundness rapidly decreases. This can be determined by finding out how loud a noise is necessary to wake a person at various periods of sleep.

The Machinery Keeps Working

While the big brain, the *cerebrum*, is largely out of commission in sleep, many of the automatic subordinate centers continue active. Respiration goes on, though more slowly. The heart beats more slowly. Many reflexes are active. A person who is asleep will pull away his foot when it is tickled. He knows nothing about it, for the knowing part is off duty.

You might say that this is like a city where the main telephone system is discontinued at night, but the wires for the police and fire houses are still open. The body attends to the absolutely necessary things in sleep; but most of its activities are suspended.

One might think that during sleep when the brain is being repaired it would need more blood. But that is not so. Every organ needs most blood when it is in action; that is, when processes of combustion are going on and a large amount of oxygen must be supplied. The brain is no exception. During sleep it receives little blood. We say it is "anemic." One of the earliest signs of waking is the appearance of more blood in the brain. People in other conditions than sleep may become unconscious from too little blood in the brain, as in fainting.

As a result of these facts some scientists believe that the withdrawal of blood from the brain is the cause of sleep. Others think the anemia of the brain is a result, rather than the cause, of sleep. At present we have to say that the fundamental change that brings on sleep is not understood.

Most adults need about eight hours of sleep in twenty-four. Children need more. Coffee, tea, and some other drinks contain the drug caffein, which in many people produces sleeplessness. These drinks, therefore, should be used sparingly before bedtime.

We spend about one-third of life asleep. This shows its importance. Do everything you can to make your sleep healthful. Have a regular time for sleep. Have plenty of fresh air and not too many bedclothes. Then you will love your sleep and say with old Sancho Panza, "Blessings on the man who first invented sleep!"

SLIME MOLDS. Sometimes you will find a slimy yellow or orange mass, from the size of a pinhead to that of a man's hand, in forests upon black soil, fallen leaves, or decaying logs. These perplexing forms, called "slime molds," do not seem to be related to any group of plants and have raised the question as to whether they are to be regarded as plants or animals. The ordinary body is a mass of naked protoplasm, called the *plasmodium*, suggesting the term "slime." This body slips along like a gigantic amoeba. In certain conditions these slimy bodies come to rest and organize elaborate and often very beautiful spore-cases. Scientific name of slime molds, *Myxomycetes*.

SLOE. Dark purple branches ending in sharp points or spines, and studded with pure white blossoms or small round blue-black fruit mark the sloe, or blackthorn, a shrub closely related to the plum. It grows from four to ten feet high and is found in southern Europe and central Asia. The fruit is bitter and is used only in making gin and wine and occasionally in preserves. Walking sticks, policemen's sticks, clubs and tool handles are made from the wood, which is hard and tough and capable of taking a high polish. The wild yellow plum and the black aloe, a medium sized tree, found on the eastern mountains, are American species of the sloe.

The scientific name of the European sloe is *Prunus spinosa*. Its leaves are small, resembling tea leaves, and grow on short petioles; flowers small, single, appearing in early spring usually before the leaves; fruit the size of a pea. The sloes are shrubs of the *Rosaceae* family.

Sloth. These curious animals derived their name from the fact that they usually appear lazy and sluggish in movement, though at times they show considerable agility. Sloths live in trees in the forests of Central and South America; they are indeed the most strictly tree-inhabiting of all quadrupeds. By means of their hooklike claws they cling to the branches with their backs downward, and so appear upside down. They rarely descend to the ground, and crawl on it with difficulty. Their food consists of leaves, young shoots, and fruit. They are silent inoffensive animals and move about mostly at night.

There are two sub-families of sloths—the *ai*, or the three-toed sloth; and the *unau*, or two-toed sloth. Both are covered with long coarse hair, the shafts of which are roughened or fluted. This hair is naturally grayish, but in the damp forest it is covered with a growth of algae, imparting a peculiar greenish color which makes the animal difficult to distinguish among the foliage. In dry climates the algae disappear and the hair resumes its natural color.

HE WALKS UPSIDE DOWN

The Sloth never, if he can avoid it, walks upright upon the ground. Even in his sleep he hangs upside down.

Scientific name of three-toed sloth, *Bradypus tridactylus;* of two-toed sloth, *Choloepus hoffmanni.*

Smell. The most remarkable fact about our sense of smell is the excessively small amount of substance needed to stimulate the nerve endings in the nasal passages. Some substances can be detected if as little as one thirty-billionth part by weight is present in a given weight of air. Many animals have a far keener sense of smell than man. Just imagine how infinitesimal must be the traces left which enable a bloodhound to follow a criminal many hours after he has escaped! Every dog can recognize his master by the odor, which shows that every human being must have a different odor, though it is ordinarily so faint as to be imperceptible to our own sense of smell.

In primitive men, just as in animals, smell was probably of importance in locating food and avoiding enemies. If you wish to know how different people would be if their sense of smell were as acute as that of the dog, read the story by Mark Twain entitled "A Double Barreled Detective Story."

Smell is closely related to taste, each sense being aroused by chemical substances coming in contact with the nerve endings. In the case of smell the substance must be in the form of a gas. Gases diffuse through the air, consequently we can recognize things at a distance by their odor. The endings or receptors for smell cover a very limited area in the upper part of the nasal cavities. They are so arranged that the air is drawn over them when we breathe.

Many foods have a distinct odor, and the gaseous particles reach the smell receptors when we eat. Hence we confuse taste and smell. The so-called taste of fruits, wine, etc., is really an aroma or smell. Test this by holding your nose and chewing some dry coffee. You will not "taste" anything, but the instant you take a breath the so-called "taste" of coffee will become apparent. This explains why food does not "taste" right when you have a cold. Your sense of smell is lost by the partial stoppage of the nasal passages.

The many kinds of smells have been divided into nine classes. But the actual number of fundamental odors or kinds of olfactory endings is not definitely known.

Smells are intimately related to the emotions. Hence the division of odors into agreeable and disagreeable is probably fundamental and forms the basis on which many animals take their food and know their enemies, mates, etc. Among civilized men likes and dislikes may be cultivated, hence people do not agree as to which odors are pleasant.

Smith, Captain John (1580–1631). The story of the life of Captain John Smith, as told by himself, reads more like a tale from the 'Arabian Nights' than like a true autobiography. According to his own account he ran away from his home in England at an early age, to seek adventure. While traveling through France he was robbed and left helpless in a forest, but was saved from death by a kindly peasant. Sailing from France with some pilgrims bound for the Holy Land, he was thrown overboard by his companions because they regarded him—a Protestant heretic and unbeliever—as responsible for the storm by which their lives were threatened. He saved himself from the sea, however, and later fought in a war against the Turks, three of whom he killed in a single combat. He was afterward captured and sold into slavery by the Turks, but made his escape by killing the guard placed over him. After wandering through Europe, he returned to England in 1605, and joined an expedition which was preparing to go to America to found the colony of Virginia.

During this voyage Smith's life was again in danger. He was accused of conspiracy, and at one time members of the party prepared to hang him. His life finally was spared, but he was kept under restraint until after the expedition reached the James River. Then it was found that Smith was one of the councilors who had been appointed by the Virginia Company in England to govern the colony. Soon he was forced by the incompetence of others to take the lead in the Jamestown settlement. He compelled all to work by his famous order, "He who will not work shall not eat." He forced the Indians to supply the starving colonists with corn, and at the same time kept the savages in order.

Soon after the settlers landed, Captain Smith had a very exciting adventure. It was generally believed that the "South Sea" (Pacific Ocean) lay just beyond the mountains, so with a few companions Smith sailed up the Chickahominy River in search of it. When the stream became too shallow to go farther by boat, he landed and with one Indian pushed forward through the forest. Soon he was set upon by a band of hostile Indians and made captive. They were about to shoot him with their arrows when he aroused their curiosity by showing them his pocket compass, and they spared his life. After taking him to many of their villages, they finally brought him before their chief, Powhatan, a tall stalwart man dressed in a coonskin robe. Presently the Indians seized Smith, bound him, and laid his head upon a stone, while a warrior stood ready to slay him with a club. At this moment, according to Smith's account, Powhatan's little daughter Pocahontas sprang forward, clasped her arms about the captive's neck, and prevailed upon her father to spare his life and send him back to Jamestown. The truth of this romantic story is doubted by many, but the value of Captain Smith's services to the colony is acknowledged by all.

CAPTAIN JOHN SMITH BATTLES THE TURK

Captain Smith, as the champion of the Christians, killed three Turkish champions in turn. At this period (about 1600) the full suit of war harness had already gone out of use for common soldiers, but was still worn on special occasions by great nobles, and as you see here, by chosen champions.

While out on one of his many exploring expeditions Captain Smith was wounded by an explosion of gunpowder, and in 1609 he returned disabled to England, and never again set foot on Virginian soil. After recovering from his wound, however, he explored and charted the coast of southern Canada and northern United States, to which at his request Prince Charles gave the name of "New England." He also spent much time in writing, and although his works are not fully reliable, his 'True Relation of Virginia', his 'Travels', and his 'General History of Virginia' still furnish us much valuable information concerning the Jamestown settlement.

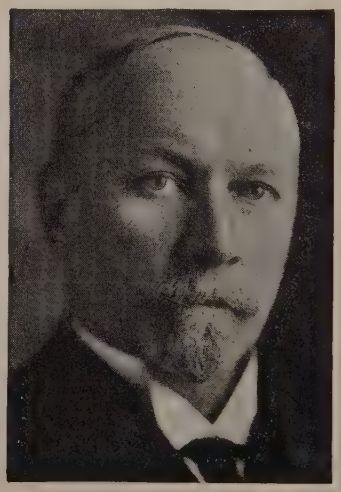
Doubtless Captain Smith was something of a kindly braggart and had an over-vivid imagination. But most certainly he was also a very active, courageous, resourceful gentleman—"ever hating baseness, sloth, pride, and indignity more than any dangers"—and to him more than to any other one man was due the success of the first colony in Virginia.

SMOKE. The vapor produced by burning any substance, usually wood or coal, is called smoke. The smoke from burning wood is almost colorless, and consists mainly of carbon dioxide and water, while that from burning bituminous coal is darker, being mixed with an oily vapor and soot, which is finely divided carbon. Acetylene gas, unless used in a special burner, gives a very smoky flame, caused by the great excess of uncombined carbon.

The more perfect the combustion, the less is the smoke. The remedy for the clouds of smoke which come from factories, foundries, and innumerable fires in many of our cities is more perfect combustion of the coal used, which also means economy of fuel. A smoke investigation in Chicago showed that the chimneys of that city were pouring out every year nearly 200,000 tons of solid matter.

Smoke in the air is one of the causes of fogs. When the temperature falls at night, moisture condenses on the small particles and they remain suspended in the air with their burden of water. The fogs of large cities, like the famed fogs of London, are largely due to incomplete combustion of fuel in the multitudes of furnaces and stoves, and the consequent production of smoke.

SMUTS, JAN CHRISTIAN (born 1870). In the final struggle of the Transvaal Boers against the British which culminated in the Boer War of 1899–1902, there were few leaders who were abler or more devoted to the Boer cause than Gen. Jan Smuts. He was the descendant of a long line of Dutch farmers, but after graduating from a Cape Colony college, he had a brilliant career at Cambridge University, England, where he had studied English constitutional history and law with Frederick William Maitland, the greatest living master of these subjects. On returning to South Africa he had soon attracted the attention of President "Oom Paul" Kruger, who appointed him state-attorney of the Transvaal when he was but 28 years old. Then when the Boer War came he won great praise as a general for his skill in carrying out rapid movements; no leader more skilfully evaded the traps set by the British, and none did more to delay the final crushing of Boer resistance.



JAN SMUTS
Boer Soldier and British Statesman

Yet less than a score of years later this brilliant enemy of British rule had become the prime minister of the whole British Union of South Africa, and was recognized as one of the greatest living statesmen of the British Empire.

In the reorganized Transvaal he had become the right-hand man of Gen. Louis Botha, the leader of the People's Party, and in 1906 had journeyed to England with him and received from the Liberal leaders of the British government the promise that the Transvaal should receive self-government. In return Smuts and Botha promised loyalty on the part of the Boers to Great Britain, a promise which they kept.

Smuts played a considerable part in bringing about the Union of South Africa (1909), and when Botha became prime minister of the Union, Smuts was made minister of defense of the interior, and of mines. He was one of the few British colonials who realized that Germany was preparing for a great war, and he feared that the Germans would use native troops—as they did—in the attempt to sweep the British from South Africa.

When the World War broke out in 1914 many of the Boers, stirred up by Germany, sought to free themselves from British control by rebellion. But Smuts and Botha had promised loyalty to the British Empire and they kept faith; they put down quickly and harshly the Boer rebellion. Then Smuts led a military expedition across the desert of German Southwest Africa, and won that territory for British rule. He headed the expedition to German East Africa, where his military strategy won reluctant praise even from German army critics.

By this time Smuts had been marked out in Britain as an important military and political figure, so he was summoned from South Africa to represent that country in the Imperial War Conference. Then he was invited to attend the meetings of the British War Cabinet, and at the close of 1918 was employed in secret negotiations with Austria for peace. During the last year of the war, he made many speeches in Britain, speeches that won world attention and marked him off as the great spokesman for British Liberal opinion. He never doubted the outcome of the war, such was his faith in the final victory of moral issues; they were stronger than armies and would prevail. He did a great deal to keep up the spirits of wearied Britain. Like President Wilson he hoped for a new world after the war; like Wilson he wished for just boundaries based upon nationality, dreamed of a peace treaty that would bring about the reconciliation of nations and make for the ending of wars, and favored a League of Nations. But he was never so optimistic as Wilson; he never was so sure that the League of Nations could be established fullgrown.

General Smuts went to the Peace Conference as the representative of South Africa. He was called upon to help frame the covenant of the League of Nations, and some parts of that document show his handiwork. But early in the making of the treaty he saw that it would fall short of his wishes; pacing the lobby of his hotel, he once said to his friends, "God is not writing this peace." At the end he signed the treaty, but issued a statement criticizing it.

Soon after his return to South Africa Botha's death made him prime minister of the Union. In July 1921, he was entrusted with the preliminary negotiations between Lloyd George and the Irish Republican leaders, a task which he performed with rare tact. Some men have dared to call him "the wisest man in the British Empire."

SMYRNA. For more than 25 centuries Smyrna, the most important seaport of Asia Minor, has been one of the chief centers of trade between East and West. There are, however, few remains of Smyrna's early greatness, for it suffered too severely at the hands of the numerous conquerors of Asia Minor, including Tamerlane, who nearly wiped it out at the beginning of the 15th century.

During most of its long life, Smyrna has been a center of Greek commerce and culture. It was settled by Greek colonists, and its population has always been largely Greek. But here, where one of the earliest Christian churches was founded and where its bishop Polycarp was martyred by the Romans in 155 A.D., are daily heard the calls to prayer from half a hundred mosques: "Allah is great! There is no God but Allah!" For Smyrna has been under the rule of the Turk since the early part of the 15th century. At the close of the World War it was given to Greece by the peace treaty, and seemed on the point of recovering from centuries of Turkish neglect and misrule. But the armies of the Turkish Nationalists drove the Greeks out in 1922 and set fire to the city. A large section was burned and thousands of the Greek and Armenian inhabitants were massacred.

Before this disaster Smyrna presented a fascinating mixture of Oriental and European life. The flags of half the nations of Europe flew above the ships in its busy harbor, and there were fine hotels, theaters, and moving picture houses in the foreign quarter.

Formerly Smyrna was noted for its beautiful rugs, but the use of machine-spun yarn and coal-tar dyes has sadly degraded the ancient art. The chief exports are figs, tobacco, raisins, hides, sponges, rugs, silk, and cereals. Population, about 350,000.

The SAGE *and* SLOW-FOOTED SNAILS

Some of the Remarkable Habits of These Creeping Creatures — Those that Own Their Own Homes, and Those that Live in the Open Air—How They Scrape Up Their Food with Tiny Files

SNAILS AND SLUGS. Dull creatures, you find the snails at first, and dismiss them as not worth your interest. But wait! Did you know that snails have a highly developed "homing" instinct by which they find their way back to their hiding places in the most wonderful and mysterious way? Did you know that a snail weighing less than half an ounce has been known to drag more than a pound of weight over a smooth table? Did you know that if a snail loses one of its "eye-horns," it simply grows another? Did you know that a snail can crawl across the edge of the sharpest razor without cutting itself? These are just a few of the interesting things about these queer mollusks.

You are looking at this Snail through a pane of glass. With the aid of the "glue" it manufactures and the wave-like movement of its "foot," it can crawl safely and steadily over the smoothest, steepest surface.

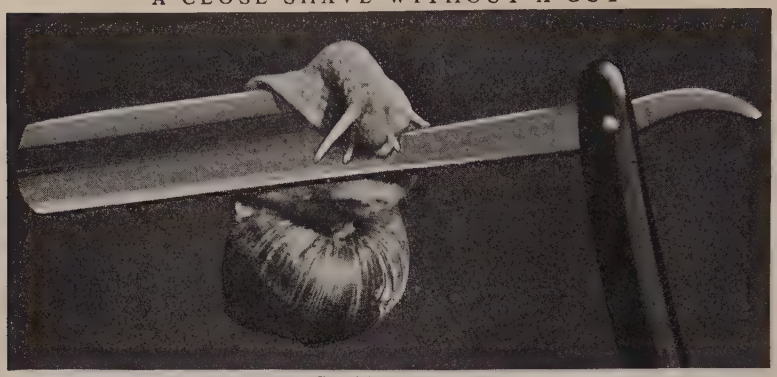
There are two great classes of snails—those with shells, and those without. Those that live in shells have a coiled body which fits into the coil of their shell; this shell they carry about with them. Their bodies are provided with strong muscles by means of which the body can be withdrawn entirely within the shell when danger threatens. Some snails have a horny disk on the foot which is just the size of the opening of their shell. When the snail is fully withdrawn within the shell this horny disk just closes the opening, and thus the soft body is completely protected. Other snails seal up the doors of their houses with a slimy substance which hardens, and in this sealed-up condition they can live through a dry period which would otherwise kill them.

In its slow-going travels, the Snail drags its coiled shell along on its back, while its horn-like eyes are extended, turning inquiringly from side to side. If disturbed, however, horns and all are drawn back into the shell.

Some land snails, commonly called slugs, have no shells, or only very tiny scales, on the back. Their bodies are soft, yet muscular and tough, and are straight, not coiled. The common garden slugs are small, black, or dark brown, and less than an inch in length when fully extended. Another species which is becoming common is the "great gray slug." This is a handsome creature, being light gray marked with black, and often reaches a length of four inches. It was brought into the United States some time ago from Europe. The sense of smell is very delicate in slugs, and they are able to detect the presence of food at long distances. Some slugs are very destructive to lettuce and cabbage leaves, as well as to fallen fruit. In Europe they are serious pests.

contained in the Easy Reference Fact-Index at the end of this work

A CLOSE SHAVE WITHOUT A CUT



Perhaps you have thought that the Snail is very sensitive, and needs a shell to protect him. So he does, but the skin of his foot is very tough and so made that he can climb gracefully over the edge of the sharpest razor without injury.

Snails live in salt water, in fresh water, and on land. They feed mostly on plant material, though many are flesh eaters. They cut or shred their food to pieces by means of a peculiar ribbon-like apparatus in the mouth, which is called the *radula*, a word that means "little file." The eyes, which look like tiny black dots, are located at the tips of the long antennae, or tentacles, or at the bases of the smaller pair. (*See* Eyes.) A snail can be made to withdraw the tentacles which bear the eyes by flashing the sunlight on its head with a mirror. This shows that the eyes are sensitive to light, though they are not sufficiently developed to give images of objects.

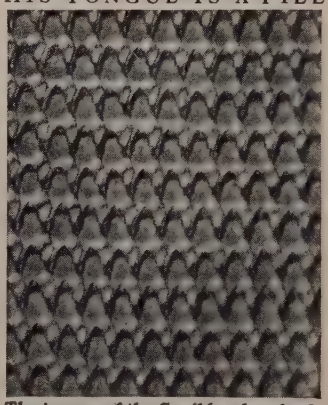
Many snails, both water and land forms, breathe air, as the mammals do. These are called the "pulmonate" snails. Their lungs are simple and saclike, and are located about the middle of the body, nearer to the head than to the tail. The breathing pore opens and closes from time to time, and can be easily seen on the back near the head, a little to one side. Snails which breathe in the water are provided with delicate fringes of leaflike gills, like those of the clam, the oyster, or the fish. Over these gills pure water is kept flowing, and from this the blood takes the oxygen. These snails, therefore, do not need to come to the surface to get air. The big marine or saltwater snails, like the whelks and winkles, which live on the bottom of the ocean, breathe in this way.

Snails multiply by laying eggs, often in wonderful capsules. Those that live on land hatch out directly as little snails; but those that live in the water come out of the egg as very minute creatures which go swimming freely through the water by means of numerous fine vibrating hairs ("cilia") located at various portions of the body. Soon the little ciliated young, or larvae, settle down, lose their cilia, and develop into snails.

Those that build shells add coil after coil to their houses as they grow, building it up from the "front door" as fast as they need more room. Some of the most beautiful of animal structures are the snail shells, especially those which come to us from tropical waters. (*See* Shells.)

Snails crawl upon the flattened under-portion of the body, which is called the "foot." This foot is very tough and muscular, though soft and smooth, and contains, in many kinds, little glands which pour out slimy fluid that makes it easy for the snail to glide.

HIS TONGUE IS A FILE



The tongue of the Snail has hundreds of tiny "teeth," with which it files away bits of food. This photograph shows some of the teeth, magnified 40 times.

The rocks on sea-coasts are often almost covered with little marine snails of many different species. These small forms are known as periwinkles. The commonest one is nearly globular, or ball-shaped, and is a very dark gray. Another pointed yellowish shell is inhabited by a snail known as the oyster drill, because it makes round holes in the shells of the oyster, upon whose soft flesh it feeds.

Several species of the shelled snails can be found commonly in ponds and streams feeding on the leaves of the water plants.

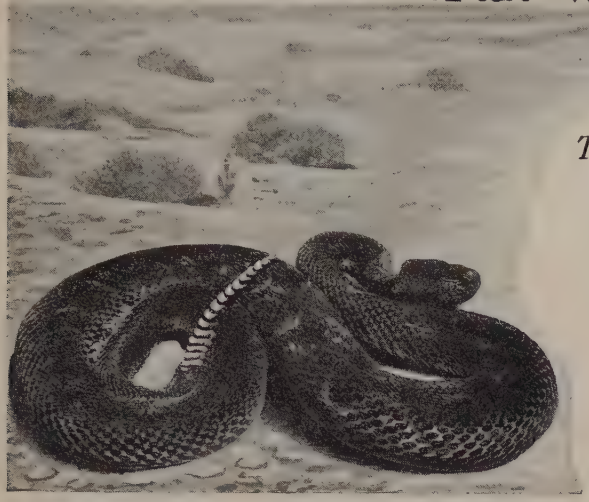
A large European land snail is eaten in France and Italy and is considered a great delicacy. Periwinkles also are eaten in England.

Snails and slugs belong to the gastropods, the largest of the mollusk classes (*see* Mollusks).

THE CARRIER SNAIL WRAPS HIMSELF IN STONE

The Carrier Snail, which lives in Borneo, is not satisfied with the protection he gets from his shell. He hides even the shell by covering it with small stones and bits of rock, which he fastens on with a cement he manufactures.

CREATURES *that* WALK *on* THEIR RIBS



The Queer Habits of the Cold-Blooded Reptiles Who Have Lost their Legs and Who Can't Close Their Eyes

SNAKES. As far as we can go back in history, we find that snakes have exerted a strange fascination upon men. In olden times they were worshiped as gods or friends of the gods; they were symbols of wealth and knowledge, and the "wisdom of the serpent" was the subject of many a proverb. Among the Greeks they were dedicated particularly to Aesculapius, the god of medicine. The part which the serpent played in the Garden of Eden is well known. In the Middle Ages they became associated with black magic and evil spirits, and countless myths center about monstrous serpents guarding treasures in caves, or dwelling in the depths of the sea. The majority of people even in civilized lands continue to look upon snakes with unreasoning fear and dread. How often you hear the remark: "I can't tell you why, but snakes make me shudder!" It isn't the danger of being poisoned that causes this, for the feeling exists toward snakes that are known to be harmless and gentle.

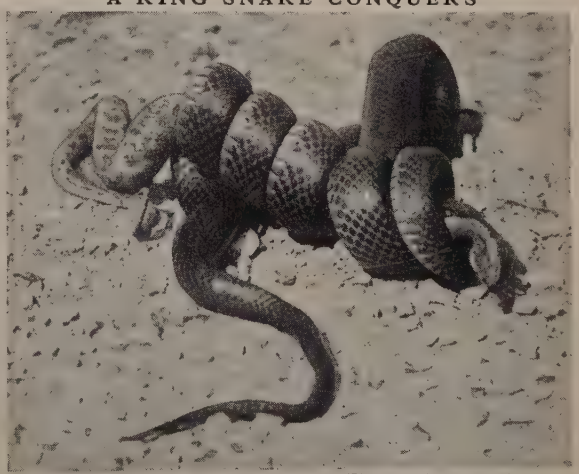
The fact is that snakes are indeed uncanny in appearance and habits. In the first place, they never close their eyes. They can't, for *they have no eyelids*, but only a tough transparent membrane to protect the eyeballs. This gives them that "cold and glassy stare" with which they are popularly supposed to hypnotize their prey. Another "creepy" spectacle is to see a snake crawl out of its old skin, appearing clean and glossy in its new dress. This habit formerly led people to believe that snakes were able to renew their life from time to time, and that they never died. Even when cut in two, the two parts were wrongly supposed to crawl together again and be mended.

How Do Snakes Get About?

But more impressive and mystifying than anything else is the motion of snakes. Their legless bodies seem to flow like living streams of water, with apparently nothing to push them or pull them. They crawl over stones, up the trunks of trees, wind themselves in the most intricate coils, then untangle again, rear their heads in the air, or glide through some narrow hole—all without seeming to exert a single muscle or move a single bone.

The secret of this is that a snake *walks with his ribs*. These are very many in number, each being fastened to a section of the backbone, and each section of the backbone being connected with its neighbors by ball-and-socket joints, which permit the greatest freedom of movement. The tips of each opposed pair of ribs are attached with muscles to one of the cross-wise scales of the abdomen. Thus the snake can move each of these scales independently, so that they act as feet, their sharp edges catching on any small roughness in the path of travel, and as they are drawn backward, pushing the snake's body ahead. When snakes are in no hurry, they usually move in a perfectly straight line, but for speed they throw their body into a series of *S*-shaped curves. In this manner many of them are able to get over the ground with amazing swiftness. No snake, however, is able to leap off the ground by the power of its coils, as might be imagined from the reports of certain travelers. Despite the lightning-like stroke of an angry snake, it never succeeds in propelling itself farther than its own length.

A KING SNAKE CONQUERS



This is a battle to the death between a King Snake and a Copperhead. You can see how the King Snake has coiled around his weaker foe, whose fanged head is already hanging powerless.

Snakes are silent secretive creatures. They appear and disappear with soundless mystery. When cor-

nered and excited they have no voice, except a long sinister hiss. Wild animals in general appeal to us by their cries, like a half-understood language. We love the cheerful humming of the bee, the chirp of the cricket, the croaking of the frog; we can even find something remotely human in the bellow of the alligator or the howl of the wolf. But snakes can make no such appeal; even the noise of the "rattler" has a "dead inhuman sound."

THE BIRTH OF A RING SNAKE BROOD

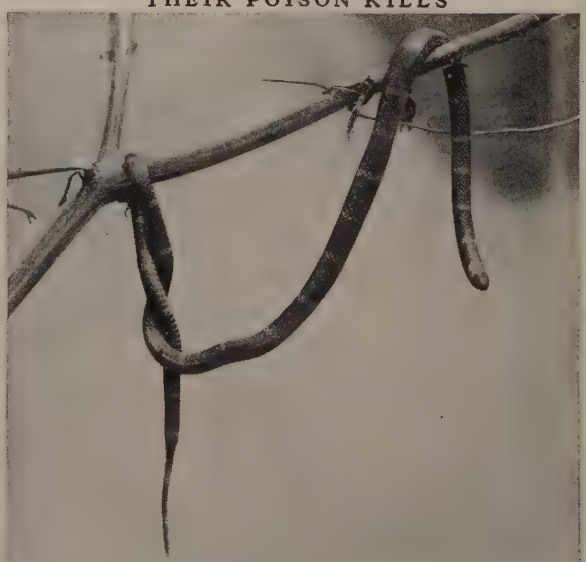
The Ring Snake is one of the species which lays eggs. Two of these young snakes are just breaking through their shells, while a third is stretching himself for the first time.

Yet when you see a snake's deep-cut mouth, curved back as in a cruel smile, and catch a glimpse of the forked tongue, darting in and out like an electric spark, it seems as if the creature could speak if it only would. In fact, however, this exhibition denotes chiefly fear and curiosity. The snake would gladly escape if it could, but instinct tells it that its long thin body is in great danger when stretched out flat on the ground; a slight blow will break its back. So it coils and hisses hoping to drive you away; and its forked tongue, which is believed to be a sense organ like the feelers of insects, is extended from its sheath on the lower jaw in the hope of finding out what sort of a being you are.

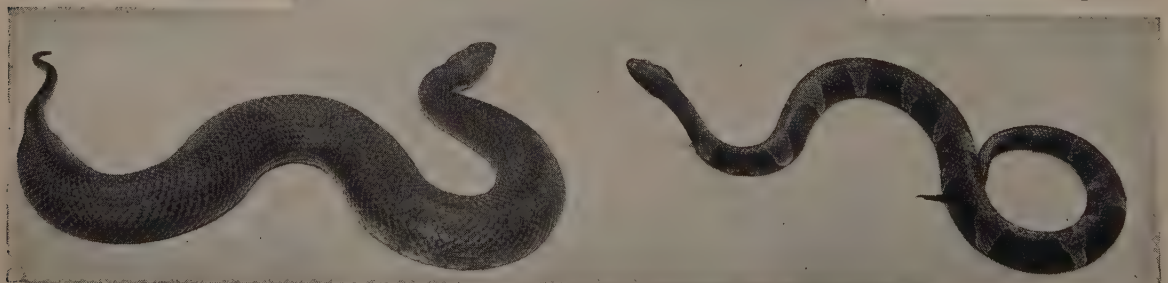
The prejudice against snakes has always blocked a better knowledge of them, yet they present an opportunity for a fascinating study. As we shall see later, there are only four kinds of poisonous snakes in North America outside of Mexico. Comparatively few people are killed by their bites, because the snakes usually do everything in their power to avoid contact with men. The victims of most of the fatal accidents are persons who become careless with captive snakes.

Nearly all snakes catch and kill their prey, which, according to the snake's size and habits, may consist of insects, fish, frogs, lizards, other snakes, birds and their eggs, rats, mice, rabbits, gophers, and other small mammals. Many snakes, like the boa constrictor and anaconda of South America, the common king snake of the United States, and others, wrap themselves around their victims and crush them by constricting or drawing together the folds of their bodies. The constricting power of a 20-foot anaconda is doubtless great enough to kill a cow, but stories of these snakes devouring cattle, horses, or men are untrue. (*See* Boa Constrictor.) The poisonous snakes usually rely on their venom to put an end to the struggles of their prey. The others simply swallow their catch without attempting to kill it first. This accounts for the fact that snakes which are disturbed immediately after a meal sometimes disgorge live frogs, lizards, etc.

THEIR POISON KILLS



The size of the morsels which snakes can swallow is astounding and indicates one of the important



Here are the three snakes which, with the Rattler, are the only poisonous snakes in the United States and Canada. At the top is the Coral Snake, a small creature with red, yellow, and black rings around its body. The heavy-bodied snake below is the Water Moccasin, while the one with the light and dark patches is its near relative, the Copperhead.

For any subject not found in its alphabetical place see information

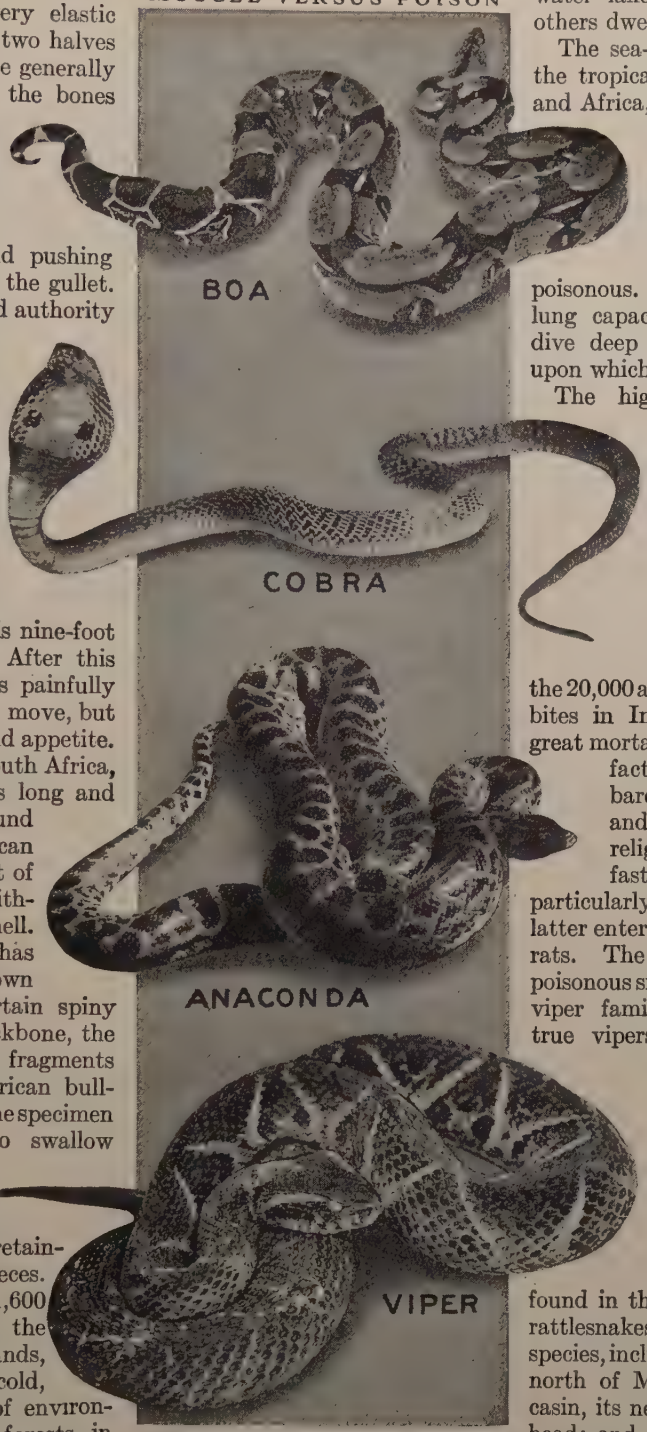
peculiarities of a snake's structure. This consists in the very elastic connection between the two halves of the lower jaw, and the generally loose attachment of all the bones around the mouth and throat which permits wide stretching. The teeth are sharp and curved backward, well suited for gripping and pushing the prey far down into the gullet.

A story is told on good authority of two captive boa constrictors which started to swallow the same pigeon from opposite ends. When their noses met in the middle, both were either unable or unwilling to stop their meal. The result was that one which was slightly larger swallowed the pigeon and his nine-foot brother snake as well. After this dinner, the survivor was painfully distended and unable to move, but soon recovered health and appetite.

The "egg-eater" of South Africa, which is rarely 20 inches long and not much bigger around than a man's finger, can perform the amazing feat of swallowing a hen's egg without breaking the shell. When the egg, however, has passed a few inches down the neck it strikes certain spiny projections from the backbone, the shell is broken, and the fragments vomited out. The American bullsnake is less particular, one specimen having been known to swallow 14 eggs in succession, crushing the shells by pressing its stomach against the ground, but retaining and digesting the pieces.

There are about 1,600 species of snakes. With the exception of a few islands, and regions of extreme cold, they exist in all sorts of environment—in dense tropical forests, in deserts, on high mountain tops. Some burrow in the ground, some live entirely on the surface, some spend most of their time in trees; others frequent swamps or fresh-water lakes and rivers; and still others dwell in the sea.

MUSCLE VERSUS POISON



The Boa and the Anaconda are the largest and most powerful of all snakes, catching and crushing their prey in their powerful coils. Yet the Cobra and the Viper, small as they are in comparison, can kill creatures the other two would not dare to attack, for they possess deadly poison fangs. These pictures, of course, do not show the relative sizes.

The sea-snakes, found mostly in the tropical waters bordering Asia and Africa, usually have the body flattened from the sides, which makes them powerful swimmers, but awkward on land. They number about 50 species—all exceedingly poisonous. They have tremendous lung capacity, so that they can dive deep in pursuit of the fish upon which they feed.

The highly poisonous snakes found on land number not more than 250 species, of which 150 belong to the sub-family called *Elapinae*, which includes the cobra and the "krait," the two most dangerous of all snakes, and which are chiefly responsible for the 20,000 annual deaths from snake bites in India (*see* Cobra). This great mortality is chiefly due to two facts; that the Hindus go barefooted through fields and jungles; and that, for religious reasons, they steadfastly refuse to kill snakes, particularly cobras, even when the latter enter their houses in search of rats. The remaining 100 highly poisonous snakes belong to the great viper family, which includes the true vipers (*Viperinae*) and the pit-vipers (*Crotalinae*). The latter family contains the rattlesnakes, the moccasins, the deadly "fer-de-lance," the bushmaster, etc. (*see* Vipers).

The four kinds of poisonous serpents found in the United States are the rattlesnakes, of which there are 14 species, including the pigmy rattlers, north of Mexico; the water moccasin, its near relative, the copperhead; and the coral snakes, with two species (*see* Copperhead; Moccasin; Rattlesnake). It is important to know them all, particularly the copperhead and moccasin, for they resemble many of the harmless

snakes. Such knowledge not only protects human beings from harm, but tends to stop the wholesale destruction "on suspicion" of all snakes, many of which are of great value to the farmer, as they eat up quantities of insects, rats, mice, gophers, prairie dogs, and other pests.

The coral snakes are among the prettiest of all reptiles. They are ringed with brilliant colors, and appear harmless and gentle. Yet they are of the same family as the deadly cobra, and their tiny fangs, which they sometimes use with treacherous swiftness, inject a poison of fatal strength. The two species in the United States are the "harlequin" and the "Sonora" coral snake, the former found throughout the South, the latter confined to Colorado and Arizona. They may be distinguished from certain harmless snakes of similar patterns by the fact that the colored rings are arranged in the following order: red, yellow, black, yellow, red. Even so, it is best not to place trust in a hasty identification.

THE HARMLESS COLORFUL GARTER SNAKE

The Garter Snakes are the most numerous and most widely distributed of all American snakes, being common in all sections except the arid western regions. Their favorite haunts are grassy meadows and the borders of streams.

The venoms found in poisonous snakes are usually clear yellowish liquids, which get their deadly power from certain highly complex chemicals of the proteid class. When the snake strikes its victim this poison usually enters the tissue immediately beneath the skin and from there is absorbed into the blood and distributed through the system. All snake poisons act principally upon the nerves with a paralyzing effect, beginning with weakness in the legs and arms, which quickly spreads to the entire body, followed by spasms, labored breathing, coma, and death.

The Poison of the Deadly Cobra

Cobra poison, which is considered the most deadly of all, creates at first a burning pain in the wound. One of its characteristic effects is to make the victim speechless after a few minutes. Rattlesnake poison, while less deadly, is more violent in its action upon the system, causing staggering fits, vomiting, swelling of the limbs, and acute spasms. There is danger that the person who survives the first effects of a rattlesnake bite may die weeks afterward from gangrene, which often sets in at the place where the poison entered the body.

In treating any snake bite the first thing to do is to tie a string or rope above the wound and twist it tightly with a stick. Then gash the wound freely with a knife to make it bleed. Some authorities warn, however, against sucking out the poison with the lips. Cauterize the wound, if possible, with nitrate of silver, or apply permanganate of potash. Small doses of some active stimulant should be administered to keep up the heart action, but large quantities of alcoholic liquors are very harmful. The string or rope must not be left on for more than half an hour or gangrene will set in. Antitoxins or "antivenins," as they are called, have been produced which are useful to snake collectors and others who handle poisonous reptiles. They are injected into the blood like other serums (*see* Antitoxins).

In addition to the highly poisonous snakes mentioned, there are about 300 species of "semi-poisonous" snakes, which, either because of the imperfect arrangement of their fangs or because of the weakness of their venom, are unable to do much harm to large creatures. Only two unimportant members of this group occur in the United States.

This leaves 1,000 or more perfectly harmless species of snakes, which are made to suffer for the sins of their venomous relatives. In many parts of the world certain of these snakes are regularly regarded as valuable household pets, being clean and quiet and ridding their adopted homes of mice and rats.

And Snakes Make Lovely Pets!

Most snakes, indeed, soon become accustomed to human society and are tame and docile in captivity. The western bull-snake, which sometimes attains a length of nine feet and is the largest North American snake, is the favorite of the circus "snake charmers"; if it is fed enough eggs and poultry, it good-naturedly permits itself to be handled in the most careless fashion. The racers, which include the indigo snake, the blacksnake, the coach-whip, and the blue racer, are other large snakes which thrive in man's neighborhood, and, if they can be kept out of the chicken coop, perform considerable service in protecting crops from rodents. The coach-whip is perhaps the speediest and most active of all snakes, darting over the rough ground almost as if it had wings.

The rat snakes or *colubers*, including the corn snake, the pilot blacksnake, the fox snake, the chicken snake, are even more deserving of man's protection, for they regularly dwell in fields of growing grain and exterminate countless numbers of small harmful creatures.

But the most unjustly persecuted of all are the innumerable varieties of garter snakes—those graceful, delicately striped creatures, whose only offense is that, like many others of the snake tribe, they give off when first captured an evil odor. But even this habit disappears in a few days. As they feed chiefly

on small frogs, toads, fish, and worms, they cannot be classed as useful; but if the snake "curse" can be forgotten, they lend bright color to the life of the countryside. They are very prolific, a single mother producing from 25 to 75 young in a single season.

Harmless Snakes that Pretend to Be Bad

There are many harmless snakes, however, that are to blame for their own misfortunes, for they do everything in their power to imitate their poisonous brothers. The familiar hog-nosed snake is a good example. The cobra and the rattlesnake together cannot present a picture of such villainous ferocity as this small creature, which cannot even be induced to bite. It hisses, and spreads out its neck, and darts its upturned nose so viciously in every direction that many people call it the "puff-adder" and are convinced of its venomous nature. Yet if you approach boldly, the hog-nose, instead of making good its bluff, will turn over on its back and pretend to be dead, remaining stiff and immovable no matter what treatment it receives. The only way you can make it betray its sham is by placing it on its stomach, when it will roll over again on its back like a flash.

Many of the water snakes (genus *Tropidonotus*), which frequent the borders of rivers, lakes, and swamps, court death by imitating the deadly moccasin. The bites of these harmless reptiles, being mistaken for moccasin or copperhead bites, and subsequently "cured" by popular or quack remedies, are responsible for a dangerous amount of misinformation about the treatment for snake venoms.

If there is a hero among American snakes, it is the king snake, which belongs to a genus (*Ophibolus*) ranging in size from 14 inches to 6 feet. The common king snake is a powerful creature from 4 to 5 feet long, marked with a striking pattern of yellow or white bands, arranged like a chain on a black background. This powerful reptile does not, as is sometimes said, actually hunt out poisonous snakes, but it gladly attacks any it may chance to meet. And whether it be a giant rattlesnake or a small copperhead, the result is always the same—the king snake wins. It coils itself quickly about its astonished adversary and tightens its grip with such strength that the victim is soon strangled, and, if not too large, it is eaten. But the king snake's courage is after all not so great, for it is immune to snake poison.

Snakes form the order *Ophidia* of the Reptile class. With the lizards, they are usually grouped in a subclass called *Sauria* (*see* Lizards; Reptiles). In several of the older families, like the boas, the skeleton shows traces of hind legs, which have been lost in the process of evolution. In this respect they show their close connection with the lizards, some of which, like the "glass snake," have no external limbs.

Although snakes seem to hear very well, they have no external ears, such hearing apparatus as they have being hidden beneath the skin. Their body is covered with even rows of scales. These scales are enlarged into fixed shields on their heads. In all but the true sea-snakes, the scales of the abdomen are modified into narrow "scutes," each one reaching clear across the belly and overlapping its rear neighbor like a shingle on a roof. This arrangement, as we have seen, takes the place of legs.

The majority of snakes lay eggs, which are whitish with a tough outer shell; but most of the vipers and all the sea-snakes bring forth living young, as do also our common garter snakes. As soon as the young are born or hatched, they are able to shift for themselves, the poisonous varieties having fully developed fangs and venom sacks.

In cold countries snakes hibernate during the winter. All the members of the order are able to go an extraordinary length of time without food, and many live to a great age.

Snipe and Sandpipers. Among the shore birds snipe are a favorite with hunters and they are much pursued. The snipe family, which includes also the sandpiper group, has about 100 species, ranging in size from the woodcock, 11 inches long (*see* Woodcock) to the "least" sandpiper, 6 inches long. The Wilson's snipe, or jacksnipe, is a delicate bird in both taste and appearance. It breeds from the northern borders of the United States north to the Arctic Sea, and migrates down across the United States during the autumn, when it is much hunted. Flashing suddenly from the grass it darts off with rapid flight, uttering its call, "*scaip, scaip, escape!*" During the winter jacksnipe are very plentiful about the marshes of Louisiana.

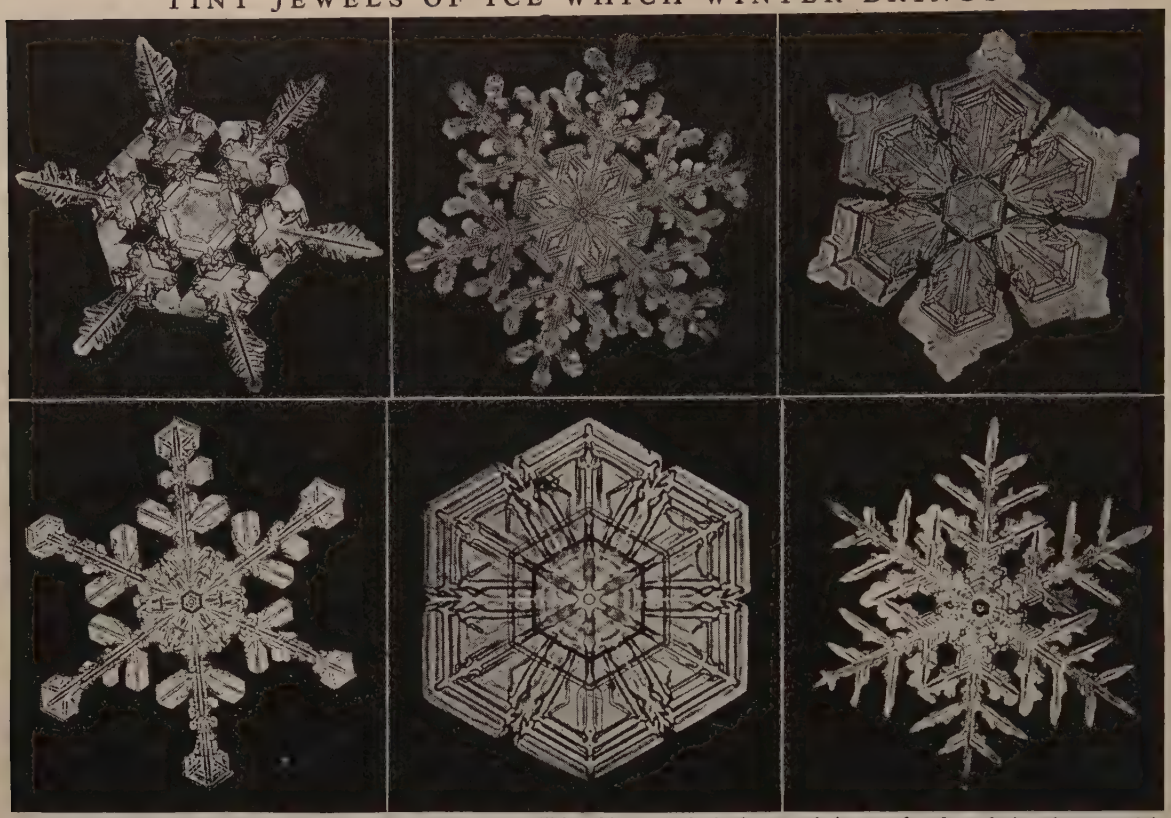
The red sandpiper, or "knot" (said to be named for King Cnut, or Canute, of England), is about the size of a robin, and in the summer has robin red-breast feathers. In the winter the breast feathers are grayish-white. After nesting in the far north, it migrates to the south, being found through Africa, India, Australia, and along the Atlantic coast of North America. The "least" sandpiper is the baby shore bird, and weighs no more than an English sparrow. With the long bill and legs of his family he is a curious little fellow. He nests north on the eastern and western coasts and winters in South America. During the mating season the male birds sing a little twittering song not unlike the song of a warbler.

The curlews, so called from their mournful cry *cur-lew*, also belong to the snipe family. Most species are of large size and they have exceedingly long slender downward-curving bills. The Eskimo curlew, or dough-bird, once found in great numbers in North America, is now, owing to the ruthlessness of hunters, almost extinct. The long-billed curlew and the Hudsonian curlew are now the most abundant species in America.

The snipes and sandpipers belong to the family *Scolopacidae;* scientific name of Wilson's snipe, *Gallinago delicata;* of red sandpiper, *Tringa canutus;* of least sandpiper, *Pisobia minutilla;* of long-billed curlew, *Numenius americanus;* of Hudsonian curlew, *Numenius hudsonicus.*

Snow. In all latitudes snow forms out of the moisture in the upper air, but melts as it falls through the lower air, if this is warm. Thus from the Equator to latitude 30°, snow is almost unknown at sea-level; from latitude 30° to about 40°, it is an occasional winter visitant; from about 40° to 75°, it is generally present during a longer or shorter period in winter; in latitudes above 75°, snow falls on perennial snow, wherever there is land. At the Equator the snow line —the height above sea-level at which snow does not

TINY JEWELS OF ICE WHICH WINTER BRINGS



Snow is really ice, shaped into minute crystals. Often you will be able to catch single crystals in your hands and give them a quick study before they melt, but more often the flakes combine in groups before they reach the earth. Although they vary greatly in details, snow crystals all belong to the hexagonal system; that is, they all have six sides or angles.

melt—is about 17,000 feet above sea-level. From the Equator it descends to about 13,500 in latitude 30°, and 1,000 feet in latitude 70°. In regions of perpetual snow, the weight of one snowfall on another may, on steep mountain slopes, produce a snow slide or avalanche; on less steep slopes, the lower part of a snow field is changed to glacial ice (*see* Glacier).

One curious snow phenomenon is seen only in low latitudes where the tropical sun in some places sculptures the perennial snow of the mountains into fantastic colonnades so like processions of kneeling human figures that the South Americans call it the "snow of the penitents."

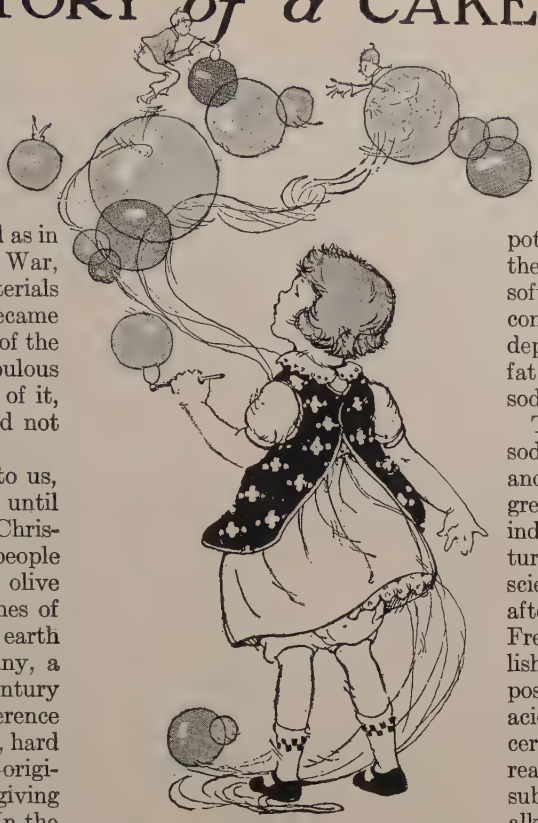
Because of the great amount of air it contains, snow is an exceedingly poor conductor of heat. Eskimos and explorers in the Arctic regions build *igloos* or huts of snow blocks, which can be kept surprisingly warm in even the coldest weather. Where winters are severe, the presence of the snow blanket protects the dormant vegetation beneath from fatal cold and keeps in the heat rising from the warmer layers of earth below.

Snow consists of water crystals, though sometimes the snow flake is a shapeless woolly tuft or pellet composed of débris of the typical six-sided crystals. Probably no other substance crystallizes in such an infinite variety of beautiful forms as water. Some crystals are flat or tabular, some are columnar needles, and some are compound structures, and the variations of these three classes are endless. The most numerous and beautiful are the flat crystals, some of which branch out into flowered rosettes, while others within the plain six-sided outline contain beautiful inlaid designs formed by tiny air tubes within the crystal structure. The most curious are perhaps the "cuff-button" doublets composed of a large and a small tabular crystal connected by a columnar needle. Crystals formed in the low clouds are usually large and branching; those from the high clouds are small and compact.

Not every snowstorm furnishes good specimens of snow crystals. The western, southwestern, and northwestern segments of great storms usually furnish the most perfect and beautiful crystals. You can imagine how difficult it is to photograph snow flakes before they melt, yet W. A. Bentley, of Vermont, the man who first accomplished the feat, has photographed more than 1,000 different forms.

Red, green, blue, and even black snow is occasionally seen in many parts of the world. The colors are due to the presence of innumerable tiny fungi, or to dust collected by the snow as it falls through the air.

The HISTORY of a CAKE of SOAP



SOAP. "Cleanliness is next to godliness," we are often told, and true cleanliness would be next to impossible were it not for soap. This humble article of everyday use was never so appreciated as in Europe during the World War, when the supply of raw materials was depleted and soap became difficult to obtain. In some of the war-ridden countries fabulous prices were paid for a cake of it, and in many places it could not be obtained at any price.

Indispensable as soap is to us, it was absolutely unknown until about the beginning of the Christian era. In earlier times people anointed their bodies with olive oil, and used juices and ashes of various plants and fuller's earth for cleansing purposes. Pliny, a Roman writer of the 1st century A.D., who makes the first reference to soap, speaks of two kinds, hard and soft, and mentions it as originally a Gallic invention "for giving a bright hue to the hair." In the ruins of the buried city of Pompeii a complete soap-making establishment was found and some well preserved cakes of the finished product, resembling closely the soap of today.

More than two billion pounds of soap are now produced yearly in the United States, where the greatest progress in its manufacture has been made. The chief producing centers are in Ohio, New York, New Jersey, Illinois, Kansas, and Massachusetts. Especially fine soaps are made in France, where Marseilles has long been recognized as the center of the soap trade, a position originally achieved because of its command of the olive oil markets.

The Chemistry of Soap

Soap is made by the action of alkali on fats or oils. A simple experiment will show you how alkali acts on grease. Put a spoonful of washing (lump) soda with a little water in a greasy frying pan and boil the mixture. In a few minutes the soda and grease will have broken up and the particles will have united to form a thick soap, which can be washed out, leaving the frying pan clean.

Soap, to most of us, means a cleansing substance which makes a lather in soft water. A chemist, however, will tell you that soaps are metallic salts of certain fatty acids. Some of these salts—those of sodium, potassium, and ammonium—are cleansing agents soluble in water; others, such as the lead soap used in pharmacy as a plaster base, are insoluble and useless as cleansers. We are concerned here only with two of the cleansing soaps, the sodium and potassium soaps, and particularly the former. A potassium soap is soft soap. Hard soap is a sodium compound; the degree of hardness depends on the character of the fat. Most commercial soaps are sodium soaps.

The discovery of the Leblanc soda process about 1791 (*see* Acids and Alkalies; Sodium) gave a great impetus to the soap-making industry of the early 19th century. It became organized on a scientific basis, however, only after the researches of the great French chemist Chevreul, published in 1823, showed the composition of animal fats (fatty acids in combination with glycerin) and the character of the reactions in saponification (the substitution of the metal in the alkali for the glycerin in the fat). This is the essence of all soaps.

Now what happens when we wash our hands or clothing with soap? You know that our sweat glands are constantly giving off a certain amount of oil, which catches dust and dirt and soils our clothing. When soap is dissolved in water and rubbed on the hands or on soiled linen, it acts in two ways: First, it forms an *emulsion* with the oil, that is, a mixture in which the oil is held suspended in very fine particles, so that the oil can be washed out with the soap solution. Second, the very fine particles of soot and dust attach themselves to the tiny droplets of the soap solution, so they too can be washed out.

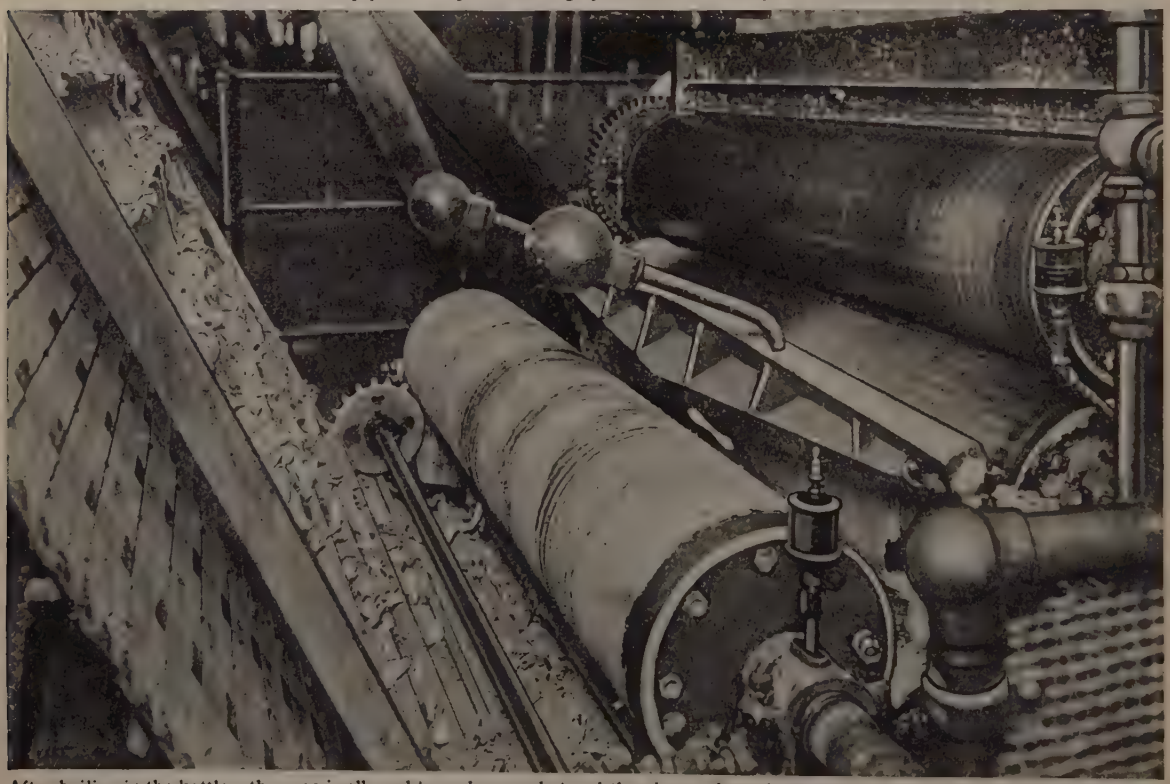
Plants that Act Like Soap

Certain plants, such as the common soapwort or "bouncing-bet" of the United States, contain a poisonous compound called saponin, which cleanses in much the same way as soap. In Chile and Peru the powdered bark of the soapbark tree (*Quillaja saponaria*) is used in washing fine fabrics. In China, the West Indies, and elsewhere soapberries (genus *Sapindus*) are similarly employed.

Every household was its own soap factory in the days of our great-grandmothers, who saved all the waste grease from their kitchens for "soap fat." For the saponifying alkali they used the lye obtained by leaching wood ashes—that is, pouring water through them to get a solution of potassium carbonate or

HOW SOAP IS MADE—BOILING AND DRYING

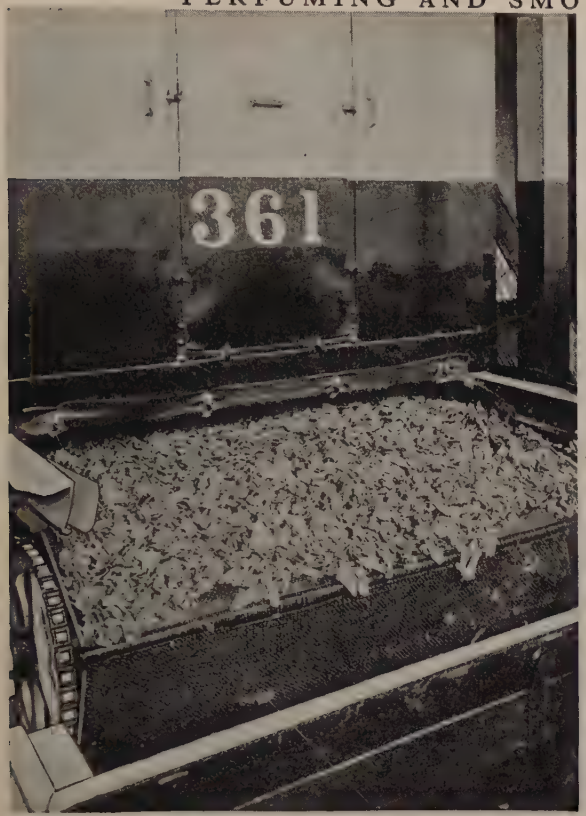
Here is the gigantic soap kettle in which the ingredients are boiled in a modern soap factory. And huge as it looks, you do not get a true idea of its real size, for this kettle is four stories deep and holds 275,000 pounds. It is heated by steam coils, and the ingredients are boiled for 11 days, until they are thoroughly blended and ready to be worked into soap.

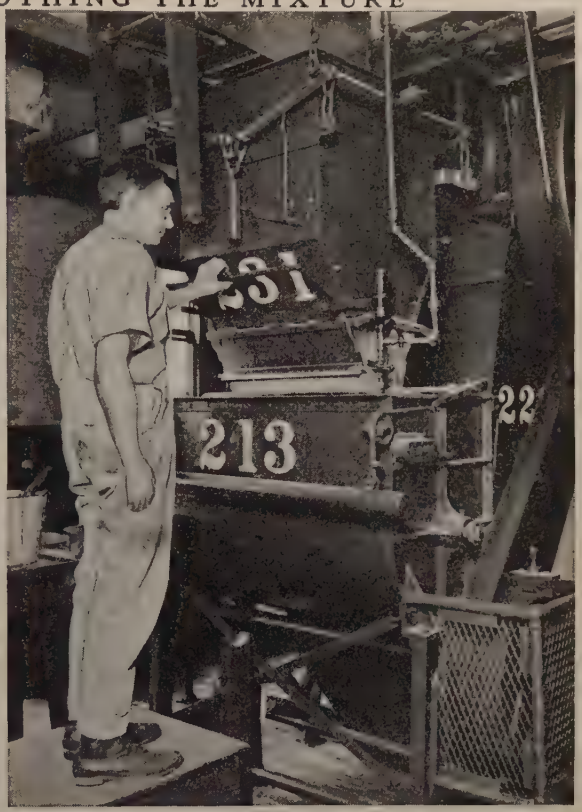


After boiling in the kettles, the soap is allowed to cool somewhat and then is run through the rollers at the right. They are of granite and are chilled with water. They congeal the liquid soap and deliver it to the heated roller in the middle of the picture. This roller irons out the soap into chips and delivers the chips to the endless belt at the left, which carries the chips into the drier.

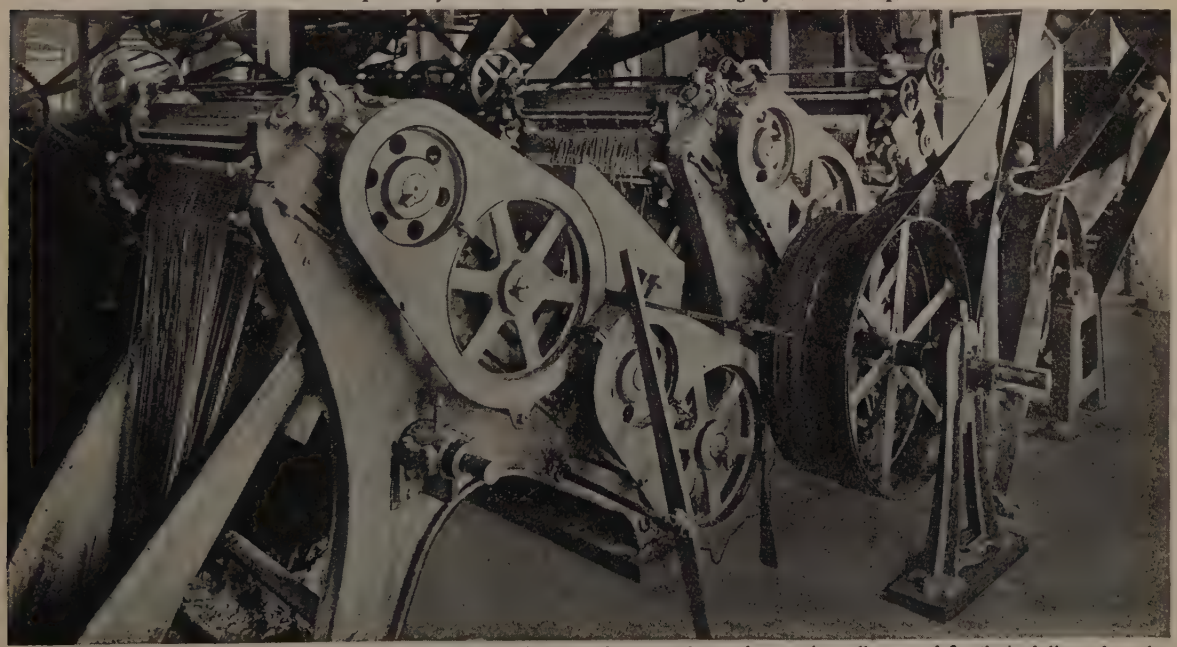
For any subject not found in its alphabetical place see information

PERFUMING AND SMOOTHING THE MIXTURE





The picture at the left shows the chips being discharged after a 25-minute journey on an endless belt through the drier at a temperature of 160°. The trip has given them just the right degree of hardness for the processes to come. In the picture at the right, the measuring scale (numbered 231) is delivering measured quantities of dried chips to the mixer (numbered 213). The mixer has an inlet for perfume, which the machine mixes thoroughly with the soap.

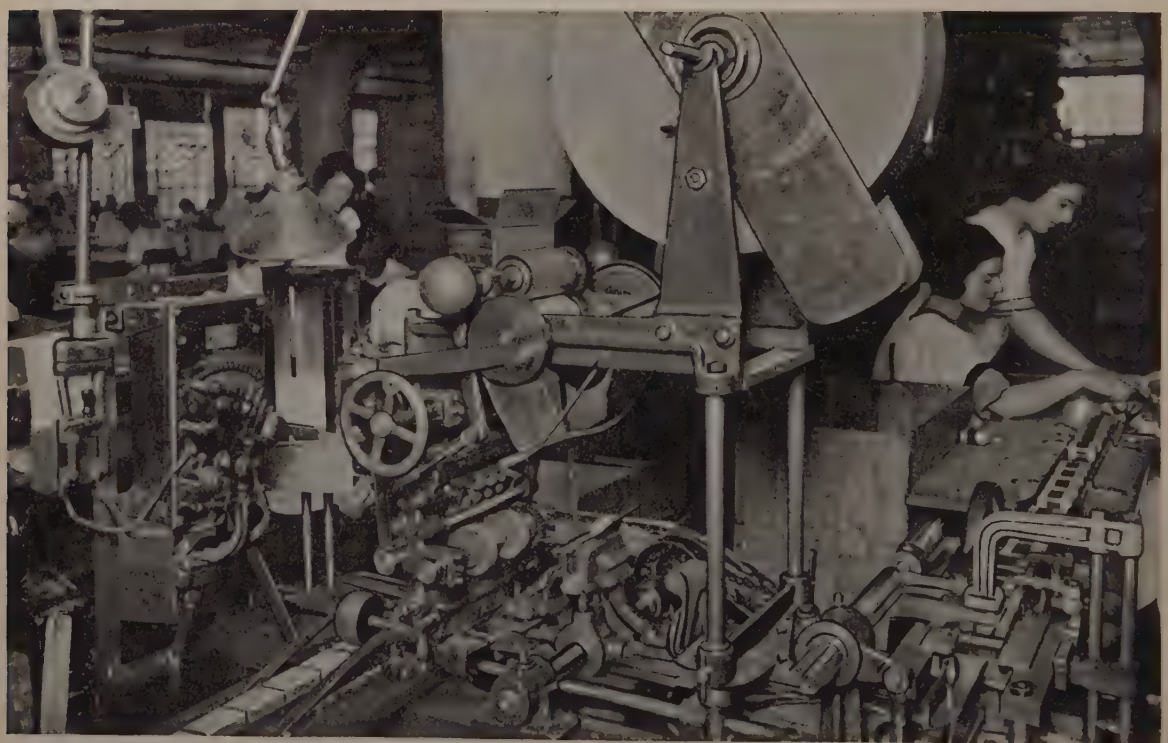


These machines are the "mills," where the scented soap is worked over and over by granite rollers, and finally is delivered as the ribbon-like strands you see at the left. This "milling" process is the secret of good soap, for upon it depends the smoothness of the finished article. Inspectors test each lot for smoothness and uniformity of mixture, and send back for further treatment any portion that does not come up to standard.

contained in the Easy Reference Fact-Index at the end of this work

CUTTING OUT AND WRAPPING THE CAKES

After the soap has been thoroughly milled, it is delivered into the hopper you see on the left. This carries it to the barring machine, where it is subjected to a pressure of 2,000 pounds. It emerges in a continuous bar, which is chopped off section after section. The man with the cap is laying these across the cutting table. There they are forced through a grill of piano wires which cuts them into cakes. You can see the cakes emerging at the right.



This complicated mechanism is the wrapping machine. You can see the cakes entering in an endless stream near the lower left-hand corner. The mechanism whisks wrappers about them, pastes on the ornamental bands, and delivers them upon the belt at the right. This belt carries the wrapped cakes past the two girls in the background, and they paste on the fancy seals which complete the ornamentation. The wrapped cakes are then taken to the packing room, where automatic machinery crates them for shipment to market.

For any subject not found in its alphabetical place see information

potash. At least once a year the accumulated soap fat was boiled up with the lye, usually in a huge kettle over an open fire in the back yard. The result was a yellowish soft soap—soft because the alkali was potash. If the housewife wanted hard soap she "salted it out" with brine, which is a solution of sodium chloride or common salt. The sodium in the salt and the potassium in the "soft soap" at once exchanged places. The resulting sodium stearate rose to the top and cooled as a solid cake of hard soap. The practice of making soap at home is still common in some rural communities, but a soda lye procured from the market is now generally used.

Either vegetable or animal fat may be used, and of the latter the fat from cattle and sheep takes first place. This is why the large slaughtering and packing houses usually have soap-making establishments in connection. The list of vegetable fats that may be used includes coconut, palm, cottonseed, and soy oil. As an excess of fat in the soap would result in too greasy a mass for the removal of the grease and dirt, and an excess of alkali would burn the skin and rot the clothing, a nice balance must be obtained.

Grandmother's Soap Kettle on a Big Scale

In the big soap-making establishments soap is made in big kettles, just as in the days of our forefathers, but the kettles bear little resemblance to those of the earlier day. They are of immense size; some have a capacity of 175 tons, equivalent to 10 or 12 carloads of the finished product. These kettles are made of steel plates riveted together, with a cone-shaped bottom. They are heated by steam coils and have inlet pipes for water, lye, and other materials.

First the fats are run into the kettles. An alkali is added and "saponification" takes place; that is, the fats break up into their component parts—fatty acid and glycerin—and the fatty acids combine with the alkali, making soap. The glycerin settles to the bottom when a saturated salt solution is added. In making ordinary yellow laundry and kitchen soaps, this glycerin, which is very valuable, is drawn off from the bottom and is carefully preserved. The glycerin is not removed from some soaps; others are made from free fatty acids in which there is no glycerin.

The soap is boiled a number of times to purify it and then is left to cool. This process, in the large vats, takes about two weeks. Then it is run off into what is known as the "crutcher," where the mass is beaten smooth by paddle blades revolving on a central shaft. Perfume and coloring matter are added to the product at this point, if desired. Resin is added to laundry soaps in the boiling, giving them their yellow color.

From the crutcher the soap goes into the frames, or molds, in the drying room. When the soap is hardened the sides of the frame are stripped off and the blocks of soap removed. They go into the cutting machines to be divided into bars, and the bars are dried, pressed into cakes, and wrapped. Some wrapping machines wrap 60,000 cakes daily.

The boiling process is the same for toilet and laundry soaps, except that the fats for the latter are of poorer quality. The toilet soaps do not go to the crutcher, but are sent directly to the drying room. Then they go to the mixer or "mill," where perfumes and coloring matter are added. The mill consists of a number of revolving stone rollers set closely together in an iron frame; this condenses the soap. The soap leaves the mill in the shape of thin ribbons, and is then pressed into a compact mass and cut into cakes.

Transparent soaps are prepared in two ways, either by dissolving ordinary soap in alcohol or by a "cold process" which leaves the glycerin in the soap. In the first case the alcohol solution is decanted and the alcohol distilled off; the residue is a thick transparent jelly which, when cast into forms and allowed to dry, comes out as a transparent mass. Glycerin soap consists of glycerin and soap in about equal parts. An excess of glycerin makes liquid soap. In some soaps large quantities of fine sharp sand or powdered pumice are incorporated, and the result is a scouring soap. Soap powders are powdered mixtures of soaps, soda ash, and sodium carbonate. The so-called "floating" soaps are usually made by forcing air into the hot soap. Medicated soaps contain substances which exercise a specific influence on the skin. Among the principal varieties are those that contain carbolic acid, petroleum, borax, camphor, sulphur, and mercurial salts. Castile soap is a hard white soap with olive oil as its fatty base. It approaches the nearest to a perfect soap—without smell or color. Naphtha soap usually contains kerosene, which is a powerful grease solvent.

SOAP BUBBLES. Pretty things to amuse children, but nothing worthy the attention of a serious student—probably that's what you think of soap bubbles. What would you say of a man who at 40, although nearly blind and dependent on the eyes and hands of a devoted daughter-in-law, took up the study of bubbles and left a scientific reputation largely based on his truly remarkable work with them? That is what Joseph A. F. Plateau, a Belgian physicist (1801–1883) did. He learned by the study of the soap film a great many interesting and important facts about the internal forces in liquids. And so he proved that there really is much to learn from bubbles, as Sir Isaac Newton had also done two centuries before. (*See* Newton.)

For instance, why is a bubble round? For the same reason that a raindrop is round—because a liquid surface (by virtue of a property known as "surface tension," closely related to capillarity) tends to become as small as conditions will permit, and a sphere has a smaller surface than any other solid of equal volume. This is why drops of dew are round, and why melted lead poured from a shot tower falls in spherical drops.

A bubble has two surfaces—one inside, one outside—while a drop of water has only one. The surface tension in a bubble is therefore twice as great

as that in a drop of water of the same size, so the bubble contracts until the pressure of the air within stops it. Moreover, gravity, pulling the liquid from the top of the bubble, makes the upper walls ever thinner and more fragile, so naturally the life of a bubble is brief. A soap bubble lives longer than a bubble of pure water because soapy water has less contracting power—a weaker surface tension—than pure water; and also because of a remarkable property by which the surface tension varies and the bubble mends itself, so to speak, from instant to instant. Soap bubbles of special soap solutions with glycerin have been kept for days under favorable conditions; one is recorded that lived nearly a year.

What causes the beautiful play of colors in a soap bubble? Think how many mirror surfaces a bubble has; the light that falls on it is reflected back and forth from these, and so there is interference (*see* Light) among the various trains of light waves. Where interference banishes one color, you see its complementary color in the light that remains.

Why does a bubble rise when you first blow it and sink later, if it does not break first? Your breath which blew it is warm, and warm air is lighter than cold. You can float a cold bubble, though, on the surface of a gas heavier than air, such as carbon dioxide or ether, and it floats until the heavy gas gains admission to the bubble. These are only a few of the interesting things that scientists have learned by the study of soap bubbles.

Socialism. There is an ideal country, called Utopia, which exists in the imagination of noble-minded dreamers. Its people are always happy, because life there has been made so pleasant for everyone that there is no cause for sorrow or discontent. No such place has ever in fact existed in this imperfect world, but because a number of men have thought and hoped that it might be possible for such things to be, "socialism" has come into existence.

The first socialists were called the "Utopian socialists" because they saw visions of ideal communities in which human misery could be ended. Their plan was to reconstruct society and establish a system by which the profits produced by labor should be divided among the workmen. Robert Owen (1771–1858), one of the most famous of the Utopians, was a wealthy manufacturer who made his own factory town, New Lanark in Scotland, a model community. "For 29 years," he said, "we did without the necessity for magistrates or lawyers; without a single legal punishment; without any known poor rates. We reduced the hours of labor, well educated all the children from infancy, greatly improved the condition of adults." Owen wished to establish communities like New Lanark all over the world. Each of these communities was to contain about 1,200 people. They were to live in one large building and share the profits from their labor on farm and in factory. Owen advocated his ideas before crowned heads of Europe, before a committee of the British House of Commons, and even before the United States House of Representatives. Several communities modeled on his ideas were set up in different parts of the world. The most notable of these was probably at New Harmony, in southern Indiana, where Robert Owen and a band of European scholars and companions settled in 1826. For various reasons, however, all these communities sooner or later failed. Saint-Simon and Fourier were famous French Utopians. Their ideas differed from Owen's chiefly in matters of detail. Each of those writers advocated ideal communities to be established by philanthropists for poor persons. The chief outcome of the Utopian socialist movement was the forming of coöperative and profiting-sharing industries and stores, which have been successfully introduced into many parts of the world (*see* Coöperative Societies).

Louis Blanc, a Frenchman who was at the height of his fame in 1848–49, represents a second type of socialism. It has sometimes been called "political" or "government-ownership socialism." Its chief outcome was the gradual adoption in many lands of government ownership of railroads, telegraphs, telephones, water works, etc.

Modern Socialism Founded by Karl Marx

Karl Marx, a German Jew, was the founder of modern "scientific socialism." He maintained that through all human history there had been a struggle of classes—slave against master, plebeian against patrician, serf against lord. The last phase of the class struggle would be that of the laborer against the capitalist. With the victory of the laborer the capitalist class would be abolished and the socialist state would be established. In it only those who toiled—with their hands or their heads—should receive the products of labor. Since labor was the sole creator of value, it alone had a right to the fruits of its efforts. All means of production—land, factories, means of transportation, mines, and so on—should therefore be owned by society and operated for the benefit of the community. Marx did not oppose private ownership for private enjoyment and use, nor did he favor the equal distribution of property. He opposed the use of violence and believed that the triumph of socialism would be brought about by economic growth and political action.

For a time there was a serious effort to unite all the workingmen of the world in what was called the International Working Men's Association. For a number of years it held regular congresses at different places in the world, but its formal organization was disbanded in 1875. In most countries before the World War there were national socialist political parties, the outgrowth of the ideas of Marx and continuations in principle of the International. In the United States there were two socialist parties—the Socialist Labor and the Social Democratic, the Social Democratic party being by far the stronger organization of the two.

The word "communist" is sometimes used to describe those who believe that money and all other

things which constitute wealth should be shared in common (that is, equally) among all the members of a society. Ever since the attempt to establish a revolutionary "commune" at Paris in 1871, however, and especially since the Bolshevist organization of Russia on the basis of a series of little "soviets," or local or trade councils, the word communist has taken on a new meaning. The new communists (sometimes called "anarchist-communists") differ from the socialists chiefly in that they would put the ownership of the factories and other means of production, not in the great national states, but in little local "communes" of village or city population, loosely linked into federal groups.

Socialists and the World War

Socialists generally are opposed to war, in part because they believe that wars benefit only the business and ruling classes. So, in July 1914, the German socialists called upon their government in strong terms to prevent the war into which German and Austrian statesmen were hurrying the world. But when the war actually came, the great majority of the German socialists supported their government and joined in voting the money necessary to carry it on. Only a small group of minority socialists remained true to their principles and denounced the unjustifiable war, and they were without influence so long as the war lasted. In France and Great Britain most of the socialists supported their government in resisting Germany and Austria. The small Socialist party of the United States, however, was chiefly under the influence of German and other foreign leaders, and it adopted an anti-war policy, even after that country had entered into it. Many of the ablest men of that party, however, including the candidate whom it supported for president in 1916, upheld the government in its war measures. Their view was represented by one writer who said: "The Allied cause is the cause of true international socialism. The American Socialist who does not support the cause of the United States and its allies in this war betrays the socialist cause."

The terrible disorders which accompanied the setting up the "Soviet" government in Russia, and which followed after the war when rival socialist movements sought to control the new German and Hungarian republics, did much to discredit socialism. On the other hand the government control and operation of railways, telegraph and telephone lines, coal mines and food supplies, together with the working-class legislation passed in Great Britain, the United States, and other countries, was an adoption in part of the sensible proposals of the socialists.

The Opposite Doctrine of Anarchism

Socialism should not be confused with *anarchism* (from the Greek *an*, "without," and *arche*, "rule"), which demands the utter abolition of the state. Many great and good men have believed in anarchism in this sense, for they contend that human beings, if left to themselves without prescribed laws or organized authority, will soon learn to adjust peaceably all their conflicts over property and privilege. The great Russian writer Tolstoy and his fellow countryman Prince Peter Kropotkin are examples of such "philosophical anarchists."

Most anarchist writers have not advocated violence. But the name "anarchist" was incorrectly applied to Russian revolutionaries or "Terrorists," and so came to be applied also to political murderers, bomb-throwers, and agitators of all kinds who voice their protests against government or seek to gratify their misguided desire for class vengeance by "direct action" instead of through the orderly process of legislation and elections.

SOCIAL SETTLEMENTS. In the heart of one of the crowded foreign quarters of Chicago stands a group of dignified buildings, occupying an entire block. Through the main entrance flows a constant stream of people, for thousands of those who live in the neighborhood find here a second home.

This is Hull House, the most famous social settlement in America. It represents the efforts of Jane Addams and her assistants, since 1889, to make the rich and poor truly neighbors. Their purpose is to do what they can to bring culture, education, and recreation into the lives of their neighbors. (*See* Addams, Jane.)

Hull House is only one of many similar settlement houses to be found in most large cities. The first was Toynbee Hall, established in 1885 in the east end of London to the memory of Arnold Toynbee, who was a pioneer in the social settlement movement. Many others have since sprung up in Great Britain and America, and a few in other countries.

Most of those who take up settlement work are college students or college graduates. In order that they may become better acquainted with the people of the vicinity, the workers live at least part of the time in the settlement building. Only the head worker receives a salary and this is not large. The others bear their own expenses. There are always many helpers who do not live at the settlement. The workers who live in the settlement visit those about them in a friendly, neighborly way, and comfort them with sympathy and advice. In the evening men, women, and children of the neighborhood gather in the reading rooms and smoking parlors and amuse themselves with games and in other ways. Reading rooms, playgrounds, and gymnasiums are provided. Debating and dramatic clubs are popular. Evening and day classes of all kinds, including music, dressmaking, gardening, etc., are organized for those who wish to attend them. There are also clubs of other sorts—gymnastic, athletic, debating, reading, political, and so on. So far as possible, the clubs are managed by the members. There are also many lecture courses and musical entertainments. Additional features are day nurseries, employment bureaus, dispensaries, stamp-savings banks for children, and frequently the publication of a newspaper.

Sociology. The study of human society or "sociology" is one of the newest of that group of "social sciences" which includes also history, economics, and political science or the science of government. Although sociology deals with subjects that men have written and thought about ever since the times of Moses and Plato, as a science it is less than a hundred years old. Its founder was the Frenchman Auguste Comte (1798–1857), who invented the word *sociologie*. He believed that there should be a science based on all other sciences which should discover the general laws underlying human society, and from them contribute to the social well-being of mankind. From this beginning has developed a recognized science with separate departments in many universities. It treats of the origin of society in the simple organization of family and tribe among primitive peoples, and of the growth of customs and morality; of our present-day complex society, with its institutions of marriage, property, government, education, religion, organized labor, and many others; and of the problems resulting from city life, poverty, crime, immigration, races, etc. In its direct appeal to everyday life sociology is one of the most important of the social sciences. It includes "anthropology," which deals with the natural history of man and his early cultural history, and "ethnology," the science of the races and families of men. (*See* Civilization; Man; Races of Mankind.)

Socrates (*sŏk'rà-tēz*) (about 469–399 B.C.). The most familiar figure on the streets of Athens near the end of the fifth century B.C. was an awkward man, with a squat figure, a short neck, a bald head, a thick upturned nose, round prominent eyes—the very picture of an old satyr. He wore a single rough woolen garment at all seasons, and went barefoot, no matter what the weather.

Now and then he would stop some richly dressed solemn Athenian and ask him a simple question or two. The man would perhaps reply with an air of haughty wisdom, as if it were really beneath his dignity to hold discussion with so uncouth a questioner. But presently as a crowd gathered, the rich Athenian would discover that his grotesque adversary was making him seem absurd by his shrewd queries, and would depart in high anger.

The barefooted speaker was the great Socrates, the wisest philosopher of his time, whose words changed the whole course of human thought, and who today is ranked as one of the greatest moral teachers that ever lived. Despite his appearance, even the beauty-loving Greeks of his day could not resist the fascination of his speech. That young and aristocratic military genius Alcibiades said of him, "His nature is so beautiful, golden, divine, and wonderful within that everything he commands surely ought to be obeyed even like the voice of a god."

Socrates was born in the outskirts of Athens in 469 B.C. He studied sculpture, his father's profession, but soon abandoned this work to "seek truth" in his own way. His habits were so frugal and his constitution so hardy that he needed only the bare necessities of life, and he was free to devote his time to other things than making money. Once in the market place of Athens, where rich wares of every land were displayed, he cried out: "The sight of so many things that I can do without fills me with great joy."

Socrates did not know the meaning of fatigue. Once the word passed around that he had been standing in one spot since early morning thinking on some deep problem. The people gathered about to see how long he would remain there. But they had to bring out their beds to rest, for Socrates did not move from the spot until the following morning, when he greeted the sunrise with a smile and moved quietly away.

A Lion on the Battlefield

But for all his eccentricities, he was far from being abnormal or unbalanced. He fought like a lion in battle and was commended for bravery on the field of Potidaea (432 B.C.). And he was the most sociable of men, delighting in banquets at the houses of his friends, where he would exchange jokes or talk the profoundest wisdom with equal pleasure.

Socrates' wife Xantippe was notorious in Athens for her sharp tongue and evil temper; though it must be said for her that her husband's unconventional manner of life must certainly have been exasperating to a careful housewife. The sage once jokingly explained his marriage by saying: "As I intended to associate with all kinds of people, I thought nothing they could do would disturb me, once I had accustomed myself to bear the unhappy disposition of Xantippe."

Socrates soon learned to shun the artificial philosophy of his day, which led men merely into confusion and doubt. He turned to the voice of his conscience for moral truth, and he enjoyed nothing better than to confuse with his simple human questions the pompous Sophists who valued tricks of speech and shallow eloquence above clear and distinct ideas.

"Know thyself," was his motto, and he held that wisdom is virtue, that the wise man is moderate in all things, for only so can he enjoy the keen delights of the mind. He had a sincere desire to expose the absurdities in the life and thought of his time, and he did not hesitate to risk his life for justice.

Plato Tells Us About Him

Although he did not set down a word of his teachings, so far as we know, the details of his life and of his doctrine are preserved to us in the writings of the historian Xenophon, and the great philosopher, Plato, both of whom were his pupils. It was chiefly through Plato and Plato's disciple, the brilliant Aristotle, that the influence of Socrates was passed on to succeeding generations of philosophers. (*See* Aristotle; Plato; Xenophon.)

But Socrates was not appreciated by the Athenian mob and their demagogue leaders. The genius of this "gadfly of Athens" for exposing pompous frauds made him many enemies. At last three of his political

THE YOUNG ALCIBIADES LEARNS WISDOM FROM SOCRATES

Bearded Socrates, gesticulating earnestly, is directing his arguments at the youthful Alcibiades seated opposite him. Behind Socrates is another aristocratic young Athenian, not so intent on learning wisdom, if we may judge from his expression. This relief, which is notable for its graceful lines and harmony in composition, is the work of the English sculptor Harry Bates (1850–1899).

foes indicted him on the charge of impiety and corrupting the minds of the youth, and he was sentenced to die by drinking hemlock poison. Refusing to flee, at the appointed hour he swallowed the fatal draught and in the midst of quiet conversation with his friends died as he had lived, a man of unsurpassed courage. "Such was the end," says Plato, "of our friend, whom I may truly call the wisest, justest, and best of all the men I have ever known."

Sodium. Compounds of sodium flow dissolved in your blood and other body fluids. They season your food and lighten your tea biscuit and cake. They help to tan the leather for your shoes and to bleach the cloth for your garments. They form part of the glass of your windows and your tableware. They probably helped to produce the paper your books are printed on and to finish your photographs. They quite certainly entered into a hundred industrial processes whose products you use daily. In short, animals would cease to breathe and civilization as we know it would stop without the compounds of the silver-white, wax-soft metal sodium, which no one had ever seen or even imagined to exist 125 years ago.

Sodium, usually in compounds called "sodas," rules industry as potassium rules agriculture. Potassium compounds are so nearly like the parallel sodium compounds, to be sure, that the one can generally be substituted for the other in industrial processes, though the end product is not always an exact equivalent. Thus, we can use either caustic potash or caustic soda in making soap, obtaining soft soap from the potash and hard soap from the soda (*see* Soap). Sodium silicates or potassium silicates, or both, can be used in glass-making (*see* Glass), with certain resultant differences in the qualities of the glass.

The overwhelming reason why soda rather than potash is one of the foundation stones of modern industry is that soda is cheaper and more plentiful. Sodium and potassium are about equally abundant in the earth's crust, but ever since Nicolas LeBlanc in 1791 laid the foundation of modern industrial chemistry by discovering a process for making soda out of common table salt (*see* Acids and Alkalies), the world has had access to an inexhaustible source of supply of useful sodium compounds. This is not yet true of potassium compounds. So long as the sea is salt with sodium chloride (NaCl, common salt), we shall never have a "soda famine" as we have had "potash famines."

The compound properly called "soda" is sodium carbonate (Na_2CO_3), which, when crystallized with water, forms the ordinary washing soda or sal soda. Crude sodium carbonate is called soda ash. "Soda" is used in household cleansing, in manufacturing soap, glass, dye-stuffs, and explosives, in other industries of a scientific or technical nature, and as material from which other sodium compounds are made. Other important sodium compounds, with some of their uses, are: baking soda or saleratus (sodium bicarbonate), ingredient of baking powder; borax (sodium biborate), a food preservative and flux in glass-making and metal industries; caustic soda (sodium hydroxide), used in soap-making and mercerizing cotton fabrics; sodium benzoate, a food preservative; sodium thiosulphate (the photographer's "hypo," formerly known as hyposulphite), for fixing nega-

tives in photography; sodium hyposulphite (a different compound), for bleaching and dyeing; sodium disilicate ("water glass"), for preserving eggs, fireproofing wood, theater scenery, etc.

"Soda water" has nothing to do with soda. The bubbles in it are full of carbon dioxide, the same gas that raises the cake dough, and the name comes from the fact the gas was formerly produced from baking soda. Now the carbon dioxide is forced into the water under pressure in the soda fountain.

Sodium and potassium are the Great Twin Brethren of chemistry, and almost everything that has been said of potassium can be said of sodium—with a difference (*see* Potassium). Both are alkali metals, common elements, never found uncombined in nature, and familiar in certain peculiar compounds (soda and potash respectively) long before the respective elements were discovered by Sir Humphry Davy in 1807. Both elements are intensely active chemically, and when placed upon warm water unite violently with it, liberating hydrogen and setting it afire, and spinning furiously meanwhile in sputtering little balls.

The historic LeBlanc process produces soda by first heating salt (sodium chloride) with sulphuric acid. The sodium in the salt and the hydrogen in the acid change partners, producing hydrogen chloride or hydrochloric acid, and sodium sulphate or "salt cake." The hydrochloric acid passes off to be absorbed by water; the salt cake is treated with charcoal and chalk or powdered lime, producing a mixture of sodium carbonate and calcium sulphide called "black ash." The calcium sulphide is not very soluble in water; the sodium carbonate is; so the two are separated by washing out the sodium carbonate with water.

The hydrogen chloride and calcium sulphide were at first great nuisances, but about the time what is now known as the Solvay process was put on a commercial basis (1863), these hitherto troublesome wastes became valuable, the hydrochloric acid being largely used in industry and a method being found for the recovery of the sulphur from the sulphide.

The Solvay process (known by the names of the Belgian manufacturers who perfected it), which has largely superseded the LeBlanc, is essentially the treatment of strong ammonia-saturated salt brine with carbon dioxide gas, forced through it from below. The end result of the complicated reactions that follow is the production of ammonium chloride or sal ammoniac and sodium bicarbonate ($NaHCO_3$) or "baking soda." The sodium bicarbonate forms a crystalline precipitate, which is filtered out. This is then heated, driving off hydrogen, carbon, and oxygen, and leaving sodium carbonate (soda).

A still newer process is the electrolytic. The salt molecule in salt brine is split by the electric current (*see* Electrolysis) into sodium and chlorine. The sodium atom displaces one of the hydrogen atoms of the water, forming caustic soda (NaOH).

Sofia (*sō-fē'ä*), Bulgaria. From its general appearance, Sofia, the capital of Bulgaria, might almost be mistaken for a French or even an American city. It is not so picturesque as most of the Balkan cities, but it is cleaner, more modern, and more progressive. There are broad well-paved streets, electric lights, street railways, comfortable houses, and substantial public buildings. Of the old city there still remain the ruined Sofia mosque and the mosque of Buyuk-Jami, now used as a national museum and library, and the famous baths with hot springs; but the tumbledown houses and crooked streets that belonged to the days of Turkish rule have disappeared.

Situated in a mountain-girt plain, almost in the center of the Balkan peninsula, at the meeting-place of the principal highways of Bulgaria, and connected by rail with Constantinople, Belgrade, and Saloniki, Sofia is naturally a commercial center, and carries on a thriving trade in grain, hides, and attar of roses. The manufactures include silk, cloth, pottery, and tobacco. Sofia is just as progressive in education as in business. There is a university with more than 2,000 students, including many women; and also military and other schools.

Sofia stands on the site of the ancient town which the Romans called Serdica. It was taken by the Bulgarians in the 9th century; it was captured by the Turks in 1382, and occupied by the Russians in 1878. Population, more than 100,000.

The LIFE-GIVING SOIL, *More Precious Than Diamonds*

Compared to the total bulk of the Earth, the coating of soil on its surface is no more than the bloom on a peach. Yet if some gigantic hand were to polish off that coating, as you would rub the bloom from a peach, our most valuable possession would be lost. For without soil, all plant and animal life would perish.

Soil. What is the soil? How is it made? It is the broken and decayed rock of the earth's crust mixed with a little decayed animal and plant matter. It covers the surface of the earth in some places a few inches, in others a few feet to a depth of many feet. Soil is manufactured in Nature's great out-of-door factory, which has been working for thousands and thousands of years to produce the most useful of substances.

If you have watched men working in rocks with chisel and mallet, drill and dynamite, rock crusher and grinding machine, you know what powerful forces it takes to break them down, and perhaps you wonder who are the workers in Nature's factory and what are their tools. Wind, water, sunshine, frost, and many other forces are at work—most of them working so quietly that we might easily fail to discover their progress.

The sunshine beats down upon bare rock, then suddenly a cooling shower falls, and the outer surface of a great bowlder shells off suddenly as though struck a mighty blow. Rocks are worn by the beating of the rain or the rush of water over their surface in streams. Waves wear down the hardest shore by their ceaseless pounding, for they catch up the broken pieces of rock and pebbles and fling them against the rocky cliff base in a constant grinding operation. On the long level beach the waves sweep back and forth carrying pebbles which grind and polish as surely as any man-made machine could do. Similarly the wind in its travels over land picks up particles of dust and sand and dashes them against outstanding rocks, often in a veritable sand-blast. Rocks loosened by the action of wind and rain tumble down the mountainside, or are carried down by running water, pounding against other rocks in their path and perhaps breaking in pieces at the bottom of the slope. Glaciers move slowly across the land, grinding and crushing the rocks beneath. Water seeps into the rocks carrying chemicals which help to break down the natural cement holding the rock particles together. And finally, when Jack Frost comes along, the embedded water freezes and expands, splitting the rock.

Then Come Plants and Animals

As soon as the surface of a rock has been softened or crumbled by any of these agencies, tiny plants such as the lichens fasten themselves upon it. And the plants too are soil-makers, for their rootlets work down into the tiny crevices in the rock, forming a little acid which softens the material ahead of their growth, and press into it with persistent effort. Following the lichens larger plants gain a foothold, and the roots of a tree may wind themselves over the rock, sending numerous rootlets into the little cracks in its surface. The surprising fact is that the pressure of such tiny rootlets may be as great as 200 and 300 pounds to the square inch, so that their combined strength cannot be resisted permanently by even the hardest of rocks. Long roots make their way down into the subsoil (the loose earthy matter below the surface soil), helping to make it decay and drawing from it important elements of plant food.

Then there is the work of ants, earthworms, and all the varied forms of animal life that burrow through the soil. These till the soil to a greater depth than is reached by the plow of man, and their tiny efforts are multiplied by their great numbers.

Valuable additions are made to the soil by the decay of both plant and animal life. Bacteria are responsible for the decay and working over of this material into forms suitable for plant growth. Bacteria also work over other soil materials which would not otherwise be available as food for plants, and certain bacteria take the free nitrogen from the air and store it in the soil. (*See* Bacteria; Nitrogen.)

There are some seventy known chemical elements in soil, ten of which are essential to the growth of healthy plants. If the soil is lacking in these plant foods, or if the continued removal of crops has exhausted one or more of the essential elements, the composition of the soil must be changed before the land can be made productive again. This is commonly done by the addition of fertilizers (*see* Fertilizers). Certain elements occasionally found in the soil are harmful to plant growth; thus very few varieties of plant life can flourish on alkali soils, which are common in districts where there is little rainfall.

Character and Coloring of Soils

Soils are of a variety of colors, including black, red, yellow, gray, and even white, depending partly on the color of the rock from which they were made. Black soils as a rule contain a large portion of "humus" (decayed plant material) rich in plant foods. Sandy soils are often undesirable for farming because they are lacking in plant foods, dry quickly, and shift about in the wind, leaving the roots of the plants exposed to suffer from drouth. However, sandy soils are easily worked and are spoken of as "light" soils by the farmer. If properly enriched by fertilizers and properly tilled, some sandy soils are very productive. Clay makes what the farmer calls a "heavy" soil because it is so difficult to work by reason of its tenacity. A little moisture causes its particles to stick together so that it is difficult to get a plow or cultivator through it, and it also bakes when it dries, sometimes becoming almost as hard as brick. Much clayey soil is very good soil agriculturally. The finer the particles are, the more easily the plant rootlets draw out their nourishment and the more readily water is held in the soil by capillarity (*see* Capillary Attraction). The best soil for agricultural purposes contains enough clay and humus to store water and provide plant foods, enough sand to make it pervious to air and to prevent the ground from becoming waterlogged, and enough lime to prevent acidity of the soil. Combinations of sandy and clayey soils are called "loams." A vegetable loam is a soil containing much plant matter. Some of the best farming lands of the Mississippi, Rhine, Danube, and other river basins are covered with powdery yellowish-gray or brownish loam called "loess." The largest loess deposits in the world are in China, where the soil sometimes reaches a depth of several hundred feet.

When soils remain upon the parent rock from which they were made, they are called "residual." Soils carried from their original positions are called "transported" soils. "Alluvial" soils are those moved by rivers. They are found on the flood plains of rivers, and in deltas. "Aeolian" soils such as the sand dunes were deposited by the wind. "Ash" soils are the accumulation of ashes ejected from volcanoes. The soils deposited by glaciers are called "drift" soils.

A knowledge of the character of soils is so important to the farmer and land-buyer that in many states "soil surveys" by the state or federal governments are carried on and samples of the soil are chemically analyzed. Then maps are made indicating the composition and fertility of the soils in question.

Solomon, King of Israel (about 960 B.C.). Nearly three thousand years have passed since King Solomon sat on the throne of Israel, yet his glory is still undimmed and his reign is celebrated as that of the wisest and most magnificent in Israel's history. Solomon was little more than a youth when he succeeded his father David. At the beginning of his reign, the Bible tells us God appeared to him in a dream and asked him to express a wish. Solomon prayed only for an understanding heart, that he might rule his people with justice. And because he asked not for riches, nor for long life, nor for power over his enemies, but for wisdom, God rewarded him by making him not only the wisest king of his age but the wealthiest and most honored as well.

Solomon showed his wisdom in small and in great affairs. He was called upon to decide a dispute between two women, who both claimed the same child. "Divide the living child in two, and give half to the one, and half to the other," said the wise king. Whereupon one of the women cried out and begged him to give the babe to the other, thus showing that she was the real mother, since she would rather give up her child than have it harmed (I Kings iii, 16–28).

The Queen of Sheba Visits Solomon

Not only his own subjects but rulers from distant lands came to consult Solomon. The Queen of Sheba, in Arabia, having heard of Solomon's fame, came with a great train, bearing gifts of spices and gold and precious stones. Greatly did she marvel when Solomon answered all the questions and riddles which she put to him and showed her all the splendors of his court. "Behold, the half was not told me," she said to Solomon; "thy wisdom and prosperity exceedeth the fame which I heard."

Princes of many lands brought gifts of friendship and formed alliances with him, and he built up a great foreign commerce such as the kingdom had never before seen. With the help of the Phoenicians, trading vessels were sent to Ophir (a land probably in southern Arabia, famed for its gold), and as far as Tarshish (probably Spain). Gold and silver, ivory, apes and peacocks, horses, and linen, were among the rich treasures brought to Solomon's realm. "And the king made silver in Jerusalem as stones, and cedars made he to be as the sycamore trees that are in the vale, for abundance." Peace was established and the people dwelt in safety, "every man under his own vine and fig tree."

Now that there was rest from war, Solomon was able to carry out the purpose which his father David had cherished but had been unable to fulfill, the building of a great temple as a center of worship for all the land. After seven years this magnificent temple, built of stone and cedar of Lebanon, carved within and overlaid with pure gold, was completed and dedicated to Jehovah. Adjoining the temple Solomon built for himself a splendid palace, within which was placed the king's gorgeous throne, built of ivory and overlaid with gold.

But Solomon, for all his wisdom, had some very grave faults. He had many foreign wives, who turned his heart away from the pure worship of God. He allowed them to build altars to their divinities, and thus idolatry was brought into the land. In order to maintain his luxurious court, he taxed the people heavily and caused much discontent at the close of his reign. As the king's character weakened, so did his hold over the people, and his death was the signal for the division of the kingdom. On the supposed site of Solomon's temple on the eastern hill of Jerusalem, there stands today the Mosque of Omar, making the spot almost as sacred to the Mohammedan as Mecca.

Solon (about 638–558 B.C.). In the market-place of ancient Athens a crowd was once gathered about a man who, from his disordered clothing, his wild gestures, and his flashing eyes, appeared to be stricken with madness. Suddenly he broke forth in verse:

I come as a herald from Salamis, beautiful island,
And the message I bring to your ears, I have turned into song.

The crowd listened with amazement, for surely no sane man would risk his life by uttering such words. So many vain attempts had been made by the Athenians to retake Salamis from the neighboring state of Megara that in despair they had passed a law forbidding anyone, under penalty of death, to suggest another attempt. In the frenzied poet who now roused them with his stirring words they recognized the high-born Solon, who by thus feigning madness sought to escape the penalty for breaking this law. "On!" he cried—

On then to Salamis, brothers! let us fight for the beautiful island,
Flinging afar from us ever the weight of unbearable shame!

Carried away by Solon's appeal, the Athenians resolved to make one more attempt to win back the island. This time they succeeded and Solon became the hero of the day.

It was to Solon therefore that the Athenians looked in another great crisis, brought about by the new development of Athens as a commercial state. Great fortunes were being made in trade, while the lot of the laborer and peasant became harder and harder. Small farmers, obliged to borrow money at ruinous interest, were losing their mortgaged lands and were sold into slavery to satisfy their cruel creditors. A revolution threatened and the wise poet's voice was again heard:

Evil the fate of the city wheresoever misgovernment reigns,
Only good rule bringeth peace.

The people elected Solon archon—the highest office in the state—and gave him power to draft a new code of laws to displace the harsh old laws of Draco. Solon ordered all those enslaved for debt to be freed, forbade future loans on the security of a debtor's person, and cancelled all debts thus secured. He set a limit to the amount of land which a man might hold. He also improved everyone's chance of securing justice by a law providing that one who had lost a

lawsuit could appeal the case to a jury of citizens. He admitted every man, even the humblest, to serve on this jury and take part in the meetings of the assembly, and gave him a voice in the election of the magistrates, thereby laying the broad foundation of Athenian democracy.

Then, according to the old story, Solon caused these laws to be inscribed on wooden tablets, and binding the people to observe them, left Athens to travel for ten years. It was during this time that his legendary visit to King Croesus of Lydia is placed. (*See* Croesus.)

Although the revolution which Solon had sought to avoid did finally take place, with the result that Pisistratus, a member of a powerful noble family, seized supreme power, Solon's ideals of law and justice and democracy remained a powerful influence throughout Athenian history.

Solon was one of the Greek sages whom the ancients honored by calling the Seven Wise Men. Many famous sayings were attributed to them, such as "Nothing in excess"; "Know thyself"; "Moderation is the chief good." The names of the others usually included in this list are Thales, Periander, Pittacus, Cleobulus, Bias, and Chilon.

Somme (*sōm*) **River,** France. Across that northern corner of France which lies between the British Channel on the west and Belgium on the east, flows the River Somme, emptying through a broad mouth into the channel at St. Valéry, a small seaport and fishing community. It is a peaceful stream, watering many a fertile field in Picardy and turning the wheels of industry in many a rich city, including the ancient cathedral city of Amiens. Yet the upper reaches of this river saw during the World War of 1914–18 some of the fiercest and bloodiest fighting in history. In a single day the British loss on the Somme was practically as great as the entire army which Wellington commanded at Waterloo.

The first Battle of the Somme began July 1, 1916, and lasted until November 18. It is estimated that during those four months and a half, while the British and French were trying to break through the fiercely defended German lines, 500,000 men were killed on both sides and a million men more were wounded or taken prisoners.

The preparations for battle had been going on for months, particularly behind the British lines. There thousands of new troops, "Kitchener's men" as they were called, were eagerly waiting to meet the enemy and put their training to the test. Thousands of guns and millions of shells turned out by the new factories in England were massed in support of the infantry. It was to be Great Britain's first great offensive, launched while the French were still battling desperately to hold Verdun (*see* Verdun).

The line chosen for attack by Sir Douglas Haig, the British commander, extended north of the Somme in an 18-mile curve, facing the town of Bapaume, seven miles inside the German lines. The French coöperating armies were drawn up on an eight-mile front, straddling the Somme opposite Peronne.

After days of the fiercest artillery bombardment the British troops left their trenches on the morning of July 1 and advanced, expecting to find the enemy trenches battered to ruins. But the Germans, who had long known of Haig's plans, had built their dugouts so deep in the chalky soil that they had escaped the deadly effects of the British gunfire. As the attack approached, they swarmed up from their hiding places with countless machine guns and poured a withering hail of bullets into the advancing waves of men. At the same time the German batteries laid down a barrage behind the British, which not only cut off retreat but prevented reserves coming up. Surprised and trapped, the British fought with amazing courage and kept going ahead. By the end of the first day, they had lost 50,000 men, but they had gained caution and respect for an enemy that fought with a valor equal to their own.

Meanwhile the French to the south had made good progress, and during the following two weeks the first German line was taken. For the next three months after that the Allied forces pressed on step by step, taking small villages at enormous sacrifice of troops, but never succeeding in breaking through the German line. The approach of winter and the exhaustion of the men put an end to the active fighting, leaving Bapaume and Peronne still in German hands.

Although this battle was partly responsible for the retirement of the Germans the following spring to the famous "Hindenburg Line," its general results were small compared to the loss sustained.

The Second Battle of the Somme

The second Battle of the Somme, sometimes called the Battle of Picardy, marked the opening of the great German offensive in the spring of 1918. Beginning March 21, the Germans thrust out from St. Quentin toward the great railway center at Amiens, hoping to break the line of communication between the French and British armies (*see* Amiens). They advanced rapidly more than 20 miles, retaking all and more than they had lost in 1917. It was at this juncture, on March 26, that Gen. Ferdinand Foch was appointed to the supreme command of all the Allied forces, a step which largely contributed to the final victory of the Allies. In the emergency corps, made up of sappers, laborers, and supply men of all nationalities, which was formed and hurled into the defense of Amiens by Gen. Sandeman Carey, was the 11th regiment of United States engineers, who had been working on a British railway line. They seized rifles, dug themselves in, and helped to stop the German advance.

Meanwhile some French reserves had established themselves on the south flank of the drive, the British held Vimy Ridge on the north flank, and on April 1 French troops were thrown across the direct path of the advance. The Germans were blocked on all sides, and on April 6 the drive was at an end, with its tip just east of Amiens. Four months later the Germans were driven out. (*See* World War.)

SORGHUM. The sorghum plant established a reputation in the United States first as a syrup-maker. Some 30 or 40 years ago about 30,000,000 gallons of syrup was produced annually from sorghum, but its place has been largely taken today by mixed syrups, consisting of glucose and cane molasses, thus utilizing a by-product of sugar manufacture (*see* Sugar). The sweet of the sorghum is in the pith of the plant stems, from which it is extracted by grinding. The juice is reduced to a thick syrup by boiling and evaporation.

Many varieties of the sorghum, however, are not sweet, and really the most important use in the United States for sorghum, even the sweet sorghum, is for forage. It makes an excellent pasturage for hogs, and for sheep, cows, and horses if they are not allowed to overfeed. It is also fed as hay, or put in silos. Sorghum seed, ground, makes a good feed for cattle, as does also the ground stock fiber or refuse left after the process of syrup-making is completed.

THE MOST VALUABLE SORGHUM

This is Kafir Corn, commercially the most important of the sorghums. It was introduced into the United States about 1885, and is a valuable forage crop in many Western states.

Kafir corn is one of the best known forage varieties (*see* Kafir Corn). Another interesting member of the sorghum group is broom corn, which grows the thick and strong seed-head or brush used in the manufacture of brooms. Milo maize, durra, Egyptian rice corn, Jerusalem corn, and brown corn are other well known and useful varieties.

Sorghum was cultivated 4,000 years ago in Africa and in some parts of India and China. In these countries it is valued today chiefly for its seed, which is a staple food of the natives. Some of the non-saccharine (sugarless) sorghums are particularly valuable crops in regions where the rainfall is light, such as the dry-farming areas of western United States.

The sorghums (botanical name *Andropogon sorghum* or *Sorghum vulgare*) belong to the grass family. Many of them are classed with the Millets (*see* Millet). They have jointed, pithy stems, growing from 4 to 20 feet tall. The plant resembles Indian corn or maize except that it is earless, the seeds growing on the plumelike top or head on the end of the stalk.

The VIBRATIONS *of* MATTER *Which We Call* SOUND

Why Sounds Grow Fainter with Distance—Why We See a Lightning Flash before We Hear the Peal of Thunder—The Difference between Noise and Music

SOUND. Watch a plucked guitar or mandolin string; touch lightly a bell or a drumhead that has just been struck. So long as it gives forth sound, each instrument quivers with vibrations. Lay your hand firmly on any of them; the vibrations stop and so does the sound. Why?

Because, when the particles of the mandolin, the guitar, the bell, or the drum have been set vibrating, they stir up vibrations in the air which, beating on your ear drums, produce what we call sound (*see* Ear). Like light and heat, sound is the result of wave motion, though of a different character.

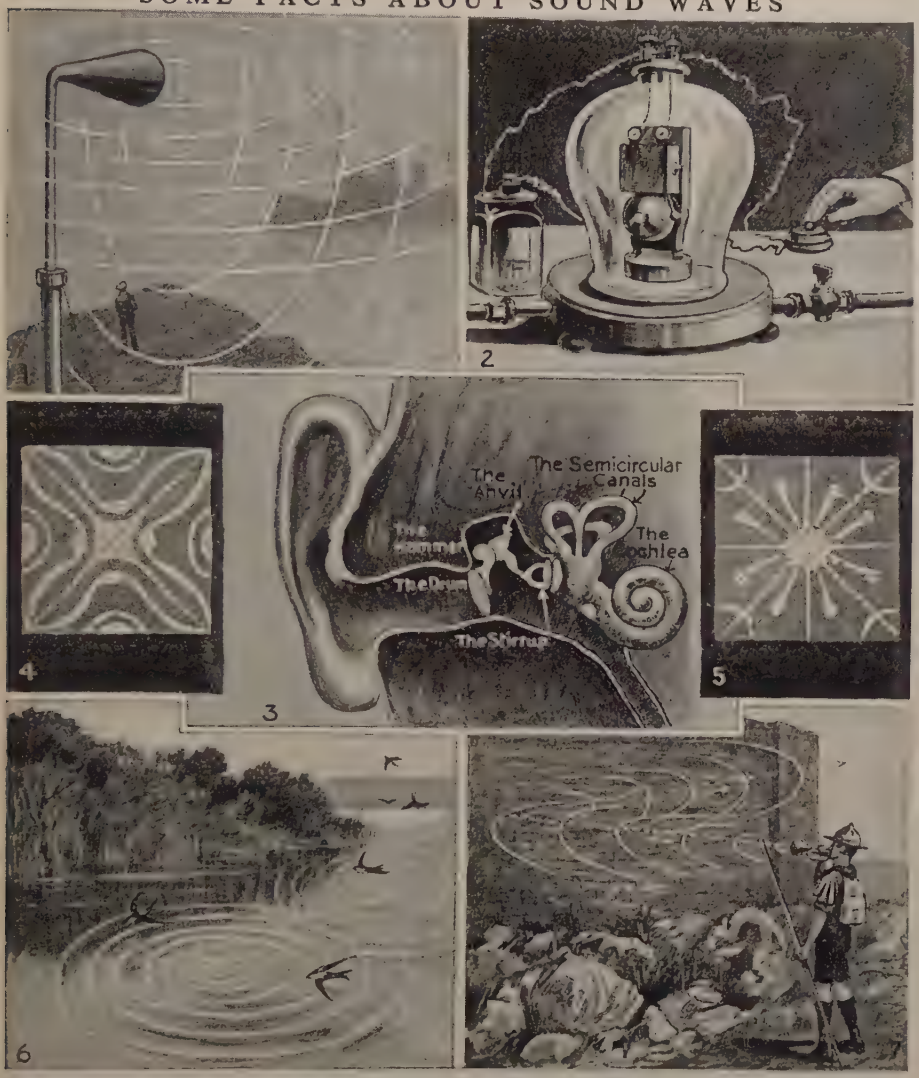
If you could put any of these sound-producing instruments under a glass bell and gradually exhaust the air, the sound would become fainter and fainter, no matter how strongly the vibrations continued. Why? Because, unlike waves of light and heat, which are produced by ether vibrations, sound travels only through material bodies; it cannot jump what we call a vacuum—a space occupied only by ether.

Get someone to make a barely audible tapping or scratching at the farther end of a long table; then put your ear against the table and see how much louder the tapping sounds. This shows that air is not the only body that transmits sound. A bunch of feathers or a sheet of cork, to be sure, is a bad sound transmitter; but this is because neither vibrates.

Sounds generally reach our ears through the air, however; so the study of sound is chiefly the study of vibrations in air caused by various vibrating bodies. One very important additional difference between light and heat vibrations and sound vibrations is that the former are transverse (crosswise), while the latter are longitudinal (lengthwise). We often represent sound waves by a wavy line—and very satisfactorily, provided we remember that such a line does not show the path of the particles of air. This path is really a straight one, each particle moving backward and forward with and against the direction in which the wave is moving. Imagine concentric rings of dancers, each circle, beginning with the inmost, first widening out until it touches the next outer ring, then contracting again, while the individual dancers do not change relative positions except as they surge out and in; this, roughly, is the way the individual particles of air move back and forth as concentric spheres of compressed and rarefied air widen out from a source of sound.

Compared to light, sound is a laggard. It travels only 1,089 feet a second in air at 32° F., the speed increasing a little over one foot a second for every degree rise in temperature. We see distant lightning long before we hear the peal of thunder because light travels so much faster than sound (186,000 miles a second). You can easily tell how far away a storm cloud is by counting the number of seconds between the flash and the thunder. Each second means about 1,100 feet. In water sound travels about four times as fast as in air.

SOME FACTS ABOUT SOUND WAVES



When vibrations are set up in the air, as by a fog-horn (1), the vibrations travel as sets of great circular waves in all directions. An electric bell in a vacuum jar (2) is almost inaudible, proving that sound is not carried through a vacuum. The human ear (3) is simply an elaborate sound gatherer, with a vibrating drum, and small bones to transfer the vibrations from the drum to the nerves in the cochlea. Next we see an ingenious way by which sound is made "visible." The two steel plates (4 and 5) were set vibrating and sand was sprinkled upon them. The sand promptly arranged itself in those peculiar rhythmic patterns, outlining, so to speak, the shape of the musical note vibrations sent out by the plates. The overlapping sets of waves made on the surface of the pool by the dipping swallows (6) illustrate how sound waves in the air may cross one another in a similar way without interference. An echo (7) is produced when sound waves are reflected by some obstacle, just as water waves strike the shore and roll back again.

Sound grows fainter with distance; in exact scientific formula, the intensity varies inversely with the square of the distance. Loudness or intensity depends on amplitude of vibration. We can easily see why this is so; as the sound waves move out from the center, the original impetus given them is spread out thinner and thinner over an ever larger shell of condensation and rarefaction. We can understand, too, why a megaphone or speaking trumpet increases the apparent volume of the voice.

Why do we hear the flight of a humming-bird, a quail, or grasshopper, but not that of a hawk or an owl? Why does an electric fan buzz, while a lady's fan stirs the air silently? For the same reason that a stone sharply hurled starts ripples widening out from the place where it strikes the surface of the pond, while a similar stone gently lowered into the water scarcely stirs its surface. With the slow gentle motion of the bird's wing, the fan, or the stone, the air or the water flows softly around it; a swift sharp impact is necessary to produce sound waves in the air or ripples in the water.

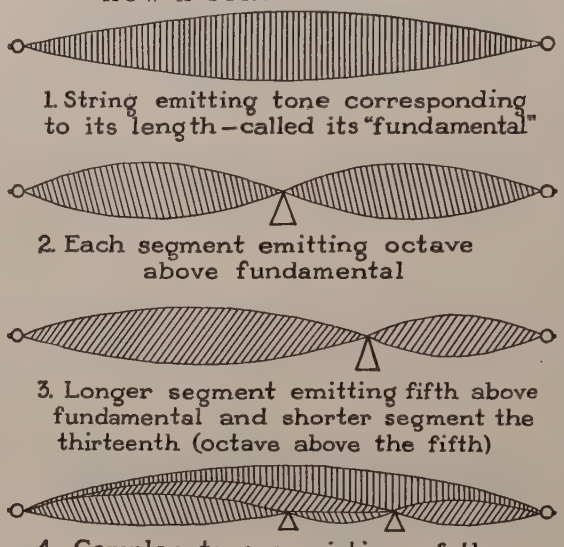
A locomotive whistle rises to a shrill shriek as it approaches and dies away to a low mournful wail as the train departs. The whistle is emitting vibrations at the same rate all the time. The reason that the note sounds higher and higher as the train approaches, and lower and lower as it departs, is that your ear in the one case receives the vibrations crowded together into shorter waves, and in the second they are dragged farther and farther apart into longer waves (Doppler's Principle).

contained in the Easy Reference Fact-Index at the end of this work

A bird's song and a pig's grunt are both sounds, but one is a beautiful musical tone while the other is an unpleasant noise. What makes the difference? The regularity and irregularity of their vibrations. In noise, as distinguished from music, the vibrations are either irregular in frequency or so complex as to be felt as irregular.

In music we feel a certain relation between certain notes. Why? What constitutes the difference and the relation between low C, middle C, and high C, for instance? The Greek philosopher Pythagoras found long ago that if he divided a tense string into two unequal parts, of lengths bearing to each other the ratio of 1 to 2, the short portion produced a note an octave above that of the long portion. The same principle holds good of notes produced by vibrating columns of air; in an organ the high notes are produced by short pipes and the low notes by long pipes. We now know that the vibrations of the short strings are twice as numerous per second as those of the long string. In any instrument tuned to international pitch, low C is produced by about 129 vibrations per second, middle C by about 258, and high C by about 516.

HOW A STRING VIBRATES


1. String emitting tone corresponding to its length—called its "fundamental"
2. Each segment emitting octave above fundamental
3. Longer segment emitting fifth above fundamental and shorter segment the thirteenth (octave above the fifth)
4. Complex tone consisting of the others combined

At the top is a simple string in vibration, the vibrations being strongest at the center and gradually weaker near the fastened ends. The note which this string gives will always be the same, provided the tension remains constant; this note is called the "fundamental." Other notes are produced on this same string by varying the position of the edged object, and thereby breaking the string into various segments. In no musical instrument, however, has it been possible to keep separate the notes produced by the various segments, but these notes combine, as in No. 4, to produce overtones which give each instrument its peculiar quality.

An even more interesting relation exists among these notes. If you set a string in vibration it gives forth a certain note, characteristic of its length, tension, and thickness. Suppose now you set an edged object, such as a coin, against its middle point. The string no longer vibrates as a whole, but each segment vibrates, and the note emitted by each part is the octave of the note emitted by the entire string. Now shift the edged object so as to touch the string one-third of the way from one end. The string now gives a chord, the long portion emitting the "fifth" (sol, or G if the tonic is C) above the note for the entire string, and the short portion emitting the octave above this "fifth." If we touched the string at both points, and gently enough so that its vibration is not checked, we get all these notes at once.

Where Musical Instruments Get Their Tone

We have produced these effects by touching the string with an edged object. But musical instruments by their construction cause the vibrating medium—either a string or a column of air—to vibrate in segments as well as throughout its length, in much the same way, so that whenever a note is sounded, these "overtones" or "partials," as they are often called, sound above it. The violin, for instance, has a certain set of partials; the flute has another; and it is the difference in the partials which are set up that give each instrument its peculiar "tone" or *timbre*.

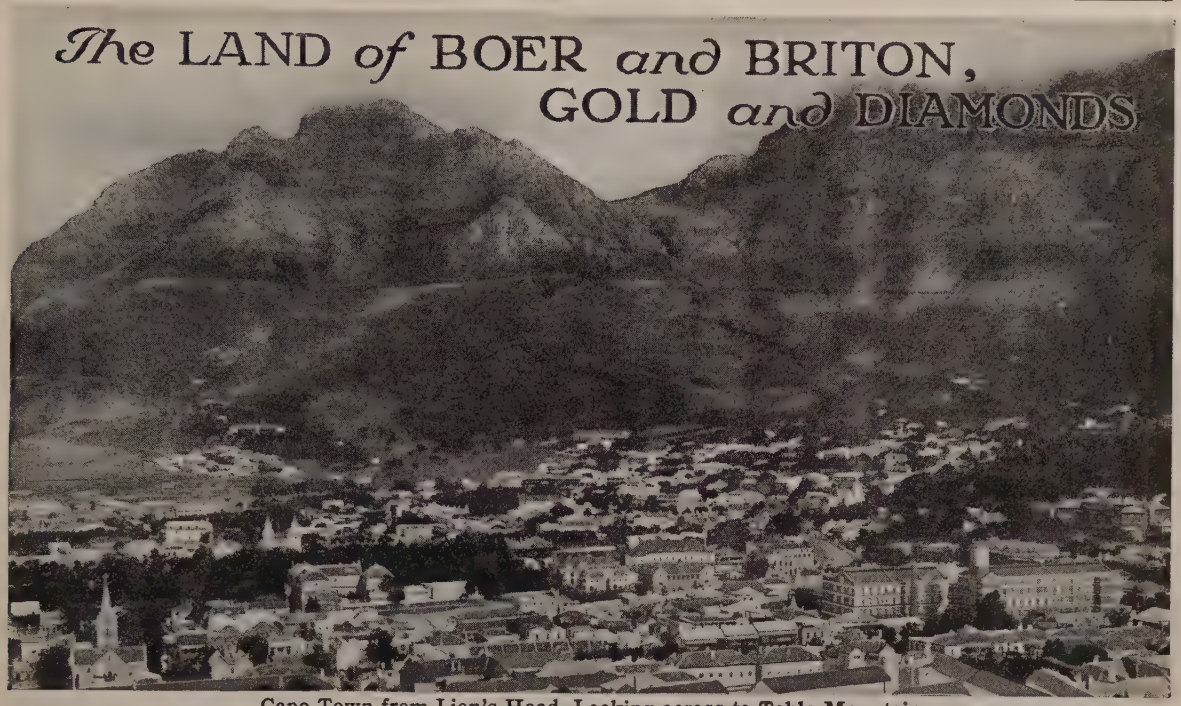
Human ears differ in their capacity both to hear sound and to recognize pitch. The limits of audibility at the lower end of the scale are given as from 12 to 33 vibrations per second, and at the upper end as between 20,000 and 40,000. The range of musical tones, however, lies between about 30 and about 4,000—about seven octaves. There are a few organs in the world with bass pipes 32 and even 64 feet long, producing, respectively, 16 and 8 vibrations per second, but this is heard rather as a thudding throb than a musical note. Above 4,000 vibrations per second sounds are heard as squeals and squeaks, practically indistinguishable in pitch. The normal range of the human voice is from about 60 per second for low bass to 1,300 for high soprano—over four octaves.

Because sound is produced by waves, it can be focused, refracted, and reflected like light. In certain large buildings, as in the dome of St. Paul's Cathedral, London, sound is so focused that a whisper at one end can be distinctly heard at the other. Such a "whispering gallery" in the Hall of Statues of the Capitol at Washington has recently been destroyed by remodeling the ceiling.

The reflection of sound as echo or reverberation in public halls creates some nice problems in acoustics, as the science of sound is called. Reverberation increases with the size and height of the room; it is diminished by the presence of draperies, furniture, audience, and anything else which by breaking up surfaces tends to dissipate or "absorb" sound waves. The speaker's or singer's voice is damped and flattened if the walls are made too sound-absorbent; his words or notes are blurred and jumbled by a too prolonged or pronounced reverberation. The selection of the proper materials and design for a large auditorium, therefore, is a task which demands much scientific knowledge and close study.

For any subject not found in its alphabetical place see information

The LAND of BOER and BRITON, GOLD and DIAMONDS



Cape Town from Lion's Head, Looking across to Table Mountain

SOUTH AFRICA. The story of South Africa is a story of bold explorers and hardy settlers on unfriendly coasts, of battles against pigmy Bushmen using poisoned arrows and against Kaffir and Zulu giants wielding huge shovel-headed spears. It tells of conflicts with wild beasts, of the discovery of gold and diamonds, of the bitter clash of Boer and Briton in the wilderness, of devoted missionaries who carried civilization into desert and jungle, and finally, of peace and prosperity under the British flag.

The land in which this stirring drama was played is shut off from the ocean by ramparts of hills that rise from low-lying coasts step upon step, with barren terraces or "karoos" between. The hills ascend until suddenly the whole vast region opens out into a great plateau from 4,000 to 6,000 feet above the sea, stretching far away to the northward. Here is the treeless grass-covered, rolling "veld," and the rough scrub or "bush," where stunted acacias, dwarf mimosas, and bitter aloes fight for life in the dry soil.

Sheltered from the moist ocean breezes, the climate is bracing and healthful. Game of all kinds was formerly plentiful, and if lions and leopards made travel dangerous, there were numberless antelopes, buffaloes, zebras, and giraffes to provide meat for the hunter. In the more tropical regions along the east coast, the elephant, the hippopotamus, and the rhinoceros are still found sparingly.

South Africa, like America, was found by Europeans of the 15th century who were seeking an ocean highway to the rich commerce of India. Bartholomew Diaz, the Portuguese navigator who discovered the Cape of Good Hope in 1488, and Vasco da Gama, who reached India by that route ten years later, as well as the scores who followed in their wake, looked upon this vast southern projection of the "Dark Continent" merely as something they had to go around on their way to the "land of spices and silk." Indeed, there was little about these barren and harborless shores to attract men whose minds were fixed on the riches of the Far East. The Portuguese who led the way and others who followed them did not even bother to establish temporary stations on these coasts, for they only stopped for wood and water or to repair the damage done by the Cape storms.

This Chapter Begins with a Shipwreck

It took a shipwreck to bring about the first settlement. Dutch sailors, driven ashore in Table Bay, near the Cape of Good Hope, in 1648, were compelled to forage for themselves for several months. Rescued and returned to Holland, they gave such a good account of their discoveries that in 1652 the Dutch East India Company established a fort and a plantation in the shadow of Table Mountain. More settlers followed, and in 1687 a number of French Huguenot families, expelled from France, threw in their lot with the Dutch colonists.

The hardy pioneers of Table Bay soon tired of the petty tyrannies of the Dutch East India Company, which continued to look upon the colony as a mere stopping-off place and trading station. By 1720 the "treks" or migrations began. The hardy pioneers pushed over the northern hills or followed the mountains toward Natal, as the southeast coast had been called by Vasco da Gama, setting themselves up as independent farmers, vine-growers, and cattle-raisers.

In the Cape region the colonists had encountered the Hottentots, a friendly easy-going race of blacks, many of whom were soon enslaved. But as they reached farther into the interior they came upon natives of an entirely different spirit. In the western part of the great plateau lived the Bushmen, a race of dwarfs, averaging less than five feet in height, but shrewd and freedom-loving. The colonists made the mistake of mistreating these tiny people, and the result was that many a white man died an agonizing death from their arrows tipped with the poison of snakes and deadly spiders. The Bushmen were hunted down like wild beasts, but they refused to make peace, and today the scattered remains of this interesting race are living on locusts and roots in the Great Kalahari desert, beyond the Orange River to the north.

Toward the east coast appeared far more formidable foes. They were the Kaffirs, giants in stature, many tribes averaging six feet in height, strong, intelligent, and well organized. Once aroused to the fact that the white men were trying to seize their territory, these Kaffirs hurled themselves upon the intruders with their great assegai spears, whose blades were often 18 inches long and 12 inches wide, and fought with a courage and ferocity never surpassed among savages.

Great Britain and the Boers

Meanwhile the Napoleonic wars in Europe had made Great Britain and Holland enemies, and the British seized Cape Colony in 1795, returned it to the Dutch in 1803, but took it back again in 1806. Finally in 1814, Holland, for $27,000,000, surrendered all claim upon Cape Colony.

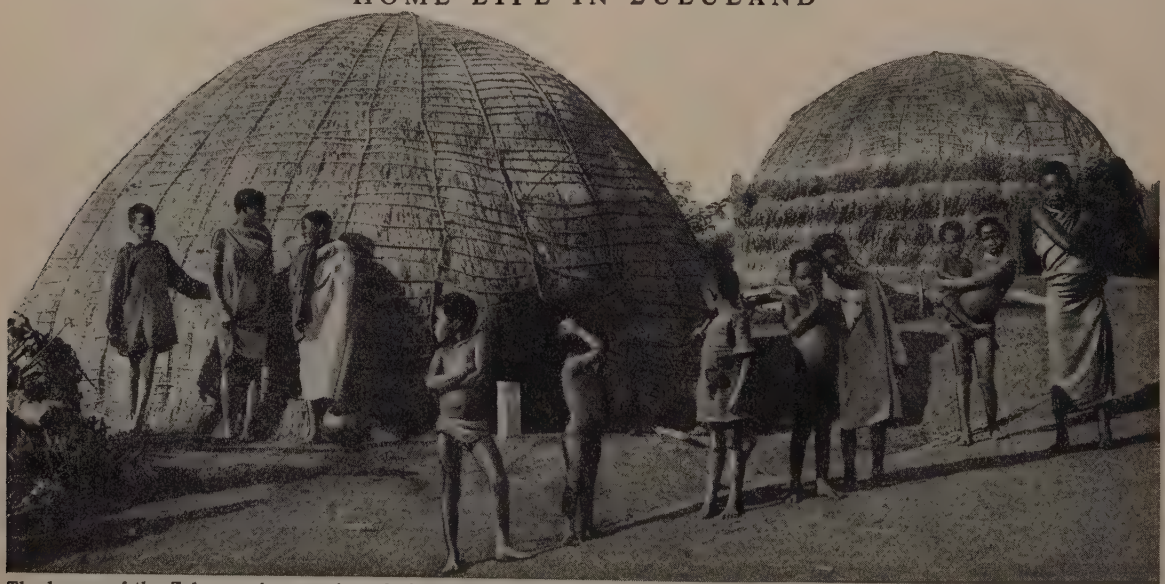
There were at that time in the Cape region, about 27,000 "Boer" settlers, as the colonists of Dutch descent were called from the Dutch word for "farmer." Most of them strongly objected to their new rulers. Great Britain in 1820 settled 4,000 of her own citizens in the colony, and British missionaries soon began interfering with the harsh treatment of the natives by the Boers. Finally, in 1834, slavery was abolished by a general law of the British Parliament, and bitter resentment spread among the Boers.

In 1836 began the "Great Trek," when 7,000 Boers emigrated from Cape Colony into the great plains beyond the Orange River, and across into Natal, and even beyond the Vaal River into the Transvaal. There these farmers and cattle-raisers set up independent republics. In Natal they failed, for this province had been colonized some years before by the British, and it was officially declared a colony of Great Britain in 1843.

After recognizing the independence of the Transvaal in 1852, the British attempted to annex it in 1877, partly on the ground of internal anarchy and the danger from the formidable military power of the Zulu chief Cetewayo, and partly to aid the federation of all South Africa into a single British dominion. Three years later the Boers took up arms in rebellion. On Feb. 27, 1881, they administered a severe defeat to the British forces at Majuba Hill, killing the general in command. Thereupon Gladstone, who had now become prime minister, withdrew the British claims to the Transvaal, and the Boers regained self-government under British suzerainty.

Meanwhile the British in 1879 had fought and conquered King Cetewayo and his trained army of 40,000 Zulus, who charged in the face of the white man's rifles with all the discipline and drill of European troops. The conflict shook the foundations of the

HOME LIFE IN ZULULAND



The homes of the Zulus are in a semi-tropical region, where clothes are a luxury and adornment rather than a necessity. Their houses, which look like beehives, are built of a framework of poles covered with thatch. A Zulu village or *kraal* is circular in form, the huts being grouped around a central open space, in which are kept the most valuable possessions of the tribe—the cattle.

For any subject not found in its alphabetical place see information

A FERRY ON THE TUGELA RIVER IN NATAL

A cable over the stream keeps the ferry-boat in its course while the ferry-man poles his square flat scow across. Tugela is one of the short rapid rivers which rise in the Drakensberg and flow east into the Indian Ocean. Eight miles north of the Tugela is Ladysmith, which was besieged during the Boer War. Their attempts to relieve that town cost the British three serious defeats before they could effect a crossing of the river.

British rule in South Africa and makes one of the most thrilling chapters in the history of this region; but in the end the British were victorious and the Zulu military system was broken up.

Affairs might have continued peaceful between the Boers and the British except for two events of great importance. The famous Kimberley diamond fields were discovered on the western border of the Orange Free State in 1869, and in 1886 came the discovery of the rich gold fields of the Witwatersrand in the Transvaal, the richest and most productive gold field in the world. There was a rush to these regions from all parts of the world by adventurers, gamblers, promoters, young men seeking their fortunes, and older men looking for serious investments.

Clash between Old and New

Thriving industrial centers suddenly grew up in the midst of the wilderness, at Kimberley, at Johannesburg, and at a score of other places. Their population increased rapidly, and South Africa saw the spectacle of these energetic progressive settlements of "uitlanders" (outlanders), eager for the advantages of modern civilization, surrounded on all sides by the old-fashioned primitive spirit of the Boers, who

JOHANNESBURG, CENTER OF THE GOLD-MINING INDUSTRY

The section of the city in which the gold mines are located looks just like any other mining town. But the residence and business sections are those of a modern city, with fine broad avenues and substantial buildings. The city was founded in 1886, and is now the largest city in South Africa, with a population of about 250,000.

were opposed to change and asked only to be allowed to continue their free life of patriarchal simplicity on the open veld. A clash between the old and the new was inevitable.

Meanwhile the commanding figure of Cecil Rhodes appeared in South African politics (*see* Rhodes, Cecil), with his dream of a great empire under British rule extending northward into Central Africa. To counteract these revolutionizing tendencies the Boers, under President Paul Kruger of the Transvaal—who believed to the end of his days that the earth is flat—organized anti-British sentiment into the "Afrikander Bond"—Afrikander being the term applied to white men of Dutch descent who had been born in South Africa. The Bond encouraged hostility to all "uitlanders," as the new settlers were called.

Rhodes, who had earlier established British authority over that vast central portion of South Africa northwest of the Transvaal known as Bechuanaland, now organized the British South Africa Company, which took over Mashonaland in 1890 and conquered Matabeleland from the native chiefs three years later. These regions, called today Southern Rhodesia, lie between the Limpopo River, the Zambezi River, and Portuguese East Africa. The Boers were now hemmed in.

For their part, the "uitlanders" on the "Rand," the Johannesburg gold district, complained bitterly against the laws of the Transvaal Boers, which discriminated against them in many ways and made it virtually impossible for any foreigner to obtain any voice in affairs. Then Joseph Chamberlain became British colonial secretary; aided by Rhodes, he supported the British claims to the utmost.

In 1895 occurred the ill-fated raid on the Transvaal, led by Dr. Leander Jameson, and the wave of bitterness it aroused rapidly hurried the Transvaal and the Orange Free State into war with Great Britain. Hostilities broke out in October 1899, and though the British were in the end victorious, it was only after three years of hard fighting, in which nearly half a million men were sent from the mother country and its colonies to South Africa. (*See* Boer War.)

Out of this conflict came a period of reconstruction and the gradual growth of friendly feeling. This culminated first in the grant of self-government to the Boers in 1906, and finally in the formation of the Union of South Africa, in 1909, which included the provinces of the Cape of Good Hope, Natal, the Transvaal, and the Orange Free State. The Union was given self-government under a governor-general appointed by the British crown. Never before in

A VAST LAND OF VELDT, MOUNTAINS, DESERT AND FOREST

The mountain ridges which skirt the eastern coast of South Africa capture the moisture of the ocean breezes, leaving the interior and the west coast arid. Yet this land hides untold riches, the central portion being little known except to a few explorers and hunters. With the exception of the two Portuguese colonies of Angola and Mozambique, and that fragment of the Belgian Congo, all the territory shown here is under British control.

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history was a conquered people so generously admitted in so short a time to full participation in the government, amounting practically to control. This happy result was due not merely to the wisdom of the British Liberal rulers at home, but also to the loyalty and statesmanship of the Boer leaders, Botha and Smuts (*see* Botha, Louis; Smuts, Jan).

The Union of South Africa has an area of nearly 475,000 square miles, and a population of 6,000,000, only about one-fourth white. Its capital is Pretoria, but the legislature meets at Cape Town. The capitals of the four provinces are Cape Town (Cape of Good Hope), Pietermaritzburg (Natal), Pretoria (Transvaal), and Bloemfontein (Orange Free State). English and Dutch are both official languages throughout the Union, but the common law is the Roman-Dutch law of the Boers.

Minerals form the greatest source of South Africa's wealth. Gold, which is found chiefly in Transvaal, leads, and amounts to about $150,000,000 annually, followed by diamonds from the famous Kimberley and Pretoria fields. Large coal deposits in Natal and Transvaal yield millions of tons of coal each year, while the copper mines of Cape of Good Hope are famous.

On the veld and karoo pasture lands graze the finest of sheep, and since the days of the early Boer shepherds wool-growing has been the leading agricultural pursuit. Angora goats are raised for mohair. The cattle and dairy industry received strong impetus from the World War, and butter became an important article of export. A profitable as well as picturesque branch of the live stock industry is the ostrich farming which is carried on in Cape Colony. Until irrigation was undertaken in 1877, the cultivation of grains and fruits was confined to the better watered area. Now nearly 1,000,000 of the 2,500,000 acres of irrigable land are receiving water, and government projects are under way to supply the rest. The largest crop is "mealies" (Indian corn), but wheat is making rapid strides toward the top, increasing its yield fourfold in a single decade. Oats, kafir corn, forage crops, and fruits are grown in the south, while on the coast of Natal sugar-cane, tea, and other semi-tropical crops flourish. Because of the drought-resistant qualities of cotton progressive farmers are devoting more and more land to it.

NEGRO TYPES OF AFRICA

At the top is a Zulu woman; at the bottom a Zulu warrior. Zulus predominate in South Africa. Above the warrior is a brown-skinned Bushman, considered the least developed of the negroes, and above him a pigmy dweller in the forests, who probably is not over four feet high.

The conditions brought about by the World War greatly stimulated manufacturing, which had previously been confined chiefly to flour, meats, tobacco, wines, and brandy. Now the tanning of leather and making of tanning extract from wattle bark are becoming important, as is the manufacture of cement, clay products, vehicles, furniture, and household utensils.

The World War of 1914–18 wiped out the great territory of German Southwest Africa. Under the name of the Southwest Africa Protectorate, it was placed under the administration of the Union of South Africa as a "mandatary" of the League of Nations.

Geographically, South Africa also includes the British territories of Basutoland, Bechuanaland, Swaziland, Rhodesia, the Southwest Africa Protectorate, and the southern portion of Portuguese East Africa (*see* East Africa), which with the Union of South Africa amount to some 1,333,000 square miles. The best grain lands in South Africa are found in little Basutoland, as well as excellent pasturage for cattle and sheep. Bechuanaland is pastoral, and Swaziland provides winter grazing for flocks of sheep from Transvaal. Rhodesia is rich in minerals and timber. Although the Southwest Africa Protectorate has large arid areas, it is capable of considerable agricultural development and it also has a rich diamond field.

The principal railroads of South Africa are the Union and Rhodesian systems. These will eventually be connected through East Africa and the Sudan with Egyptian railroads, making Cecil Rhodes' dream of an "all-red" line of the "Cape to Cairo route" come true.

The SOUTHERN HALF of the NEW WORLD

Rio de Janeiro, with Sugar Loaf Peak in the Foreground Overlooking the Harbor

Extent.—North to south, 4,800 miles; east to west, 3,300 miles; area, about 7,700 000 square miles. Population, about 60,000,000.
Physical Features.—Mountains: Andes, lower coastal mountains of Brazilian and Guiana highlands. Highest peak, Aconcagua, 22,860 feet. Largest rivers, Amazon, Parana-Plata, São Francisco, Orinoco. Most important lake, Titicaca, 5,000 square miles.
Principal Products.—Sugar cane, cotton, coffee, tobacco, wheat; rubber, cacao, brazil nuts; gold, silver, nitrate, borax, tin, diamonds, etc.; wool-growing and stock-raising.
Political Divisions.—Republics: Argentina (capital, Buenos Aires), Bolivia (Sucre), Brazil (Rio de Janeiro), Chile (Santiago), Colombia (Bogotá), Ecuador (Quito), Paraguay (Asuncion), Peru (Lima), Uruguay (Montevideo), Venezuela (Caracas). Colonies: British Guiana (Georgetown), Dutch Guiana (Paramaribo), French Guiana (Cayenne).

SOUTH AMERICA. Most people think of South America as lying directly south of North America, but this is not the case. If you were to go from New York City to the west coast of South America, you would travel almost due south through the Panama Canal; while if you went to Rio de Janeiro, you would travel east half-way across the Atlantic Ocean, for it is nearer to Spain than to New York. In reality South America from the point of view of the Northern continent is Southeastern America.

The two Americas are strikingly alike in their physical features. The southern continent is only slightly smaller than the northern, being seven-eighths its size. Both taper to a point at the bottom, and have broad bulges in the north; but while North America bulges in the temperate zone, South America bulges in the tropics, where four-fifths of its whole area lies, thus giving it a vastly different climate and a totally different destiny. Each continent is traversed by a great mountain chain from north to south —the Rocky Mountains in North America and the Andes in South America; and in each this backbone is near the western coast. In both countries the mountains sometimes break into parallel ridges and sometimes widen out into high plateaus. The Andes far surpass the Rockies in grandeur, however. They are the highest mountain mass on the globe, with the exception of the Himalayas, and Mount Aconcagua on the boundary between Chile and Argentina is the highest peak on the Western Hemisphere. The Andes are also richer in mineral wealth than the Rockies, but they have one great drawback. Volcanic eruptions and earthquakes are frequent among them, and sometimes destroy whole cities. In many places people live in houses only one story high because houses of this height are less likely to fall, and are less dangerous to their inhabitants if they do.

In both North and South America there is an independent mountain mass on the eastern side, the Brazilian Highlands corresponding to the Appalachian system. Between the western and eastern ranges in both continents is a great plain, that of the southern continent being drained by the mighty Amazon, the greatest river in the world, which discharges more water into the sea than the eight largest rivers of Asia. The valley of the Amazon in the torrid zone is for the most part a vast unexplored jungle covered with rich forests of valuable woods, adorned with flowering vines, and carpeted with an undergrowth so dense that the rubber gatherers have to chop their way through with an ax. A large part of the world's supply of rubber comes from this Amazon basin, in addition to beautiful ornamental woods—brazilwood for dyeing, cinchona for medicine, and many other products. Since there are only two seasons, wet and dry, plants grow all the year round, and bud, flower, and fruit may be seen on the same tree. Birds of brilliant plumage and chattering monkeys fill the forests with color and sound, and reptiles, blood-sucking bats, and swarming ants are found.

For any subject not found in its alphabetical place see information

Strange to say, however, large parts of South America lying in the torrid zone are so cold that little will grow there; for it is altitude above sea-level, rather than nearness to the Equator, that determines their temperature. Many regions in the heart of the tropics are so high that the mountains are covered with snow, and it is hard to believe that these bleak cold places are as near the Equator as are the hot jungles of the Amazon. People often suffer from cold in Quito, which is practically on the Equator, and the same is true in Caracas and La Paz, which lie about ten degrees from it. So abrupt are the changes of climate at various levels in the Andes that in La Paz one household servant may be sent in the morning to the heights above for a load of ice and another to lower levels for tropical fruits, both returning at noon with their strangely contrasting burdens. The fact that little moisture can pass the barrier of the Andes increases the barrenness of much of the western equatorial region.

The temperate regions farther south are, east of the Andes, much like the western plains of the United States and Canada. Enormous quantities of wheat and other grains are grown on the immense farms in Argentina, and great herds of cattle, sheep, and horses roam the wide treeless plains or "pampas." The climate too is much like that of the United States, with one great difference. The seasons are reversed because, owing to the tipping of the earth's axis, the South Pole points to the sun when the North Pole is turned from it. Here people travel south for the summer and north for the winter; and if the poet Lowell had lived in Argentina he would have had to write, "What is so rare as a day in *December?*" for that corresponds to the northern June. Not only are the seasons reversed, but the very heavens are different. The North Star, which is always visible in northern latitudes, is not seen below the Equator; while, on the other hand, the Southern Cross is a beautiful constellation that people in the north can never witness.

At the southern end of South America is a bleak and sparsely inhabited region known as Patagonia. Even here, however, are large sheep ranches, because although South America reaches farther south than any other continent, its extreme tip is no farther from the Equator than are northern Ireland or middle Labrador. Between Patagonia and the great archipelago known as Tierra del Fuego is the Strait of Magellan, the route taken by most steamers which go around the continent. This route is rocky, however, and some sailing vessels prefer to pass around Cape Horn at the southern tip, although the journey is made dangerous by the frequent storms which rage there. The main island of Tierra del Fuego is the largest island near the continent, and in fact the only one of any considerable importance except Trinidad north of Venezuela, and the group of Falkland Islands about 300 miles east of Magellan Strait, both of which belong to Great Britain.

IN THE BRAZILIAN JUNGLE

This is a scene on the River Itecoahy, a tributary of the Amazon. Were it not for the malaria which haunts its atmosphere, the Brazilian jungle would be a paradise. Practically the whole of the Amazon basin is in the equatorial belt, where Nature is in her most extravagant mood. Butterflies of brilliant hues flit from one rare and exquisite flower to another, and birds of gorgeous plumage nest amid the loveliest natural arbors on earth.

South America has a remarkably regular coast-line except in southern Chile, where the coast reminds one of the fiords of Norway or southern Alaska. There are no great projections like Alaska and Florida, and no great indentations like Hudson Bay and the Gulf of Mexico. The lack of good harbors is a great disadvantage to commerce, making it necessary in some places for the ships to load and unload their cargoes some distance from the shore by means of lighters. There is, however, no better harbor in the world than Rio de Janeiro; and the lack of harbors is partly compensated for by the great river systems, which are navigable for thousands of miles.

Over the mountains, down the great rivers, and across the plains of South America to the coast are being brought in ever-increasing quantities countless products to be shipped to all parts of the world. Pará, in northern Brazil, is the largest rubber port on the continent. At Bahia on the east coast the warehouses contain tobacco, cacao, and sugar, and at Santos just south of Rio de Janeiro, the air is heavy with the odor of coffee, and ships from all the coffee-drinking countries of the world crowd the docks. The steamers in the ports of Uruguay and Argentina tell of the extensive farms and ranches of the pampas inland, with their cattle, hides, and wheat; and still farther south at Punta Arenas, the southernmost city in the world, you see boats carrying great cargoes of wool, raised by the lonely sheep herders of the bleak plains of Patagonia. Traveling up the coast of Chile you see ships from every country waiting to receive cargoes of valuable nitrate, to be used for fertilizer, gunpowder, and iodine. From Peru cotton and sugar are carried north in large quantities, and from Ecuador are exported thousands of pounds of cacao, from which chocolate and cocoa is made, and cinchona bark from which quinine is obtained.

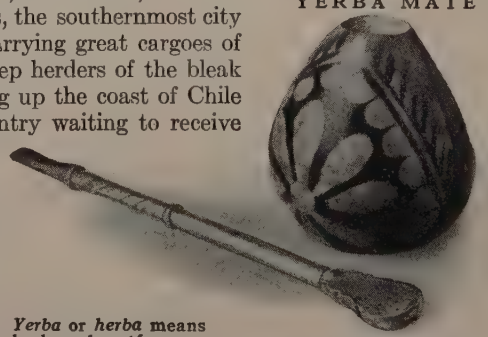
The people of South America differ as widely as do their occupations and the places in which they live. Just as we can usually tell from what country a European comes, so in most cases we can tell an Argentinean from a Chilean, although Spanish is the language of every country except Brazil, where Portuguese is spoken. Yet there are certain characteristics common to most Latin Americans. The Latin American lives a rather leisurely existence, and turns his attention to politics, literature, and the arts rather than to business. While the Anglo-Saxon race is known for its force of character, its habit of speaking directly to the point, the Latin peoples are inclined to think their northern neighbors rather rude, and to use much more ceremony in transacting business. As one writer has said, the Latin American would rather make a little money politely than be successful in making large sums using methods of the United States. Large business concerns are often in the hands of foreigners. Unfortunately in many of the countries ignorance, poverty, and superstition prevail among the great mass of the people; but the wealthier and educated classes represent the best of European culture, and a real Spanish-American literature and art is growing up.

HOLLY FOR TEA, NOT FOR CHRISTMAS

This man is carrying home a load of holly branches. He will dry the leaves, and from them brew the famous Paraguay tea, or *yerba maté*.

Love of art and beauty is shown in all the buildings, from the thatched roof and adobe hut to the government edifices and opera houses of the large cities. In most buildings, however, you will not find heat even in the coldest weather, for the South Americans believe that artifical heat is unhealthful. Private houses are not built with a yard in front or around them. The well-to-do Latin-American takes his yard into the house, or rather builds the house around it, so that all rooms open toward the central "patio," or garden. While this makes a charming home, the gardens are hidden from the passers-by, who see only bare walls and barred windows. At these windows languid señoritas sit for hours at a time, gazing out into the streets.

YERBA MATÉ



Yerba or *herba* means herb, and *maté* means gourd, but *yerba maté* is a drink made of an herb and drunk out of a gourd; in English it is called Paraguay tea. The natives put the crushed dried leaves of the South American holly in the gourd, and pour boiling water on them. They suck the tea from the *maté* through a hollow tube called the *bombilla* (little pump); this is generally of metal, with a perforated spoon-like expansion at the lower end. Like tea and coffee, *yerba maté* owes its stimulating quality to the tannin and caffein it contains.

He who looks for the tinkling guitar below the señorita's window, however, or for quaint costumes,

VARIED TYPES OF SOUTH AMERICANS

1. These are the wife and daughters of a prosperous Chilean farmer. 2. An Indian flower vendor of Caracas, Venezuela. 3. A Chuncho chief of Brazil is painting his face; the Chunchos are forest tribes. 4. Cowboys ("gauchos") of Argentina in gala attire. 5. Notice the peculiar headdress of this Aymara Indian of Bolivia, one of the tribes which live in the uplands or sierras. 6. This native Indian of the interior of Peru is carrying her baby in the shawl around her shoulders, while an older boy looks on. 7. The native women of Paraguay make cigars—and smoke them, too.

contained in the Easy Reference Fact-Index at the end of this work

will be disappointed if he visits the large cities. He will find Buenos Aires, Santiago, Montevideo, and Rio very much like the capital cities of Europe, with motor cars, electric tramways, many-storied buildings, and Parisian styles in dress. Outside the large cities, however, the costumes and customs of the people have changed little since the days of the conquistadores. This is especially true of the Indian population. The Spanish and Portuguese conquerors found the New World peopled everywhere by native tribes. Unlike the fiercer Indians of North America, these natives were docile and used to regular labor. The conquerors easily subdued them, using them at first to work the rich mines, and later to till the plantations upon which the Spanish proprietors settled and lived a life of ease. The pure Indians who remain—estimated by one writer as one-fifth of the total population—are still not entirely free, many of them being held in a state of peonage in some countries.

While there are many pure whites in South America, the distinctively Latin-American race is a mixture of the Indians and whites, who have intermarried freely. This class is known as the "mestizos," and comprises the majority of the population. Many of the cultured leaders of South America point with pride to their Indian ancestry, especially if it can be traced to the Incas. There is no race problem, because there is no race prejudice. A man is judged by his rank or class, and not the color of his skin.

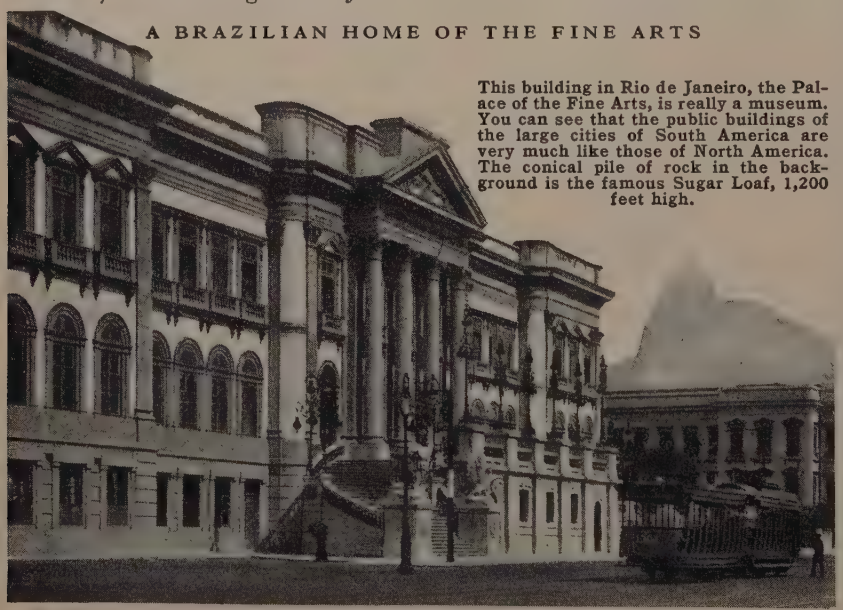
These three classes, however, are not found in all countries. The people of Uruguay are nearly all white, as are most of those in Argentina. Paraguay, on the other hand, contains few but pure Indians, who still speak their native language, and in Bolivia too the white population is very small. In Brazil the negro occupies the place that the Indian holds in other countries, for the Portuguese early introduced African slaves into their territory. Recently there has been a large immigration of foreigners, especially Germans, into all South America, and considerable numbers of Italians and other southern Europeans enter Argentina and southern Brazil every year.

FRESH MILK FOR SALE!

In most of the smaller South American cities the milkman does his work right at your door, and proves before your eyes that you are getting real milk, fresh from the cow. The calf seems somewhat disappointed at the popularity of his mother. This scene is in LaGuaira, Venezuela.

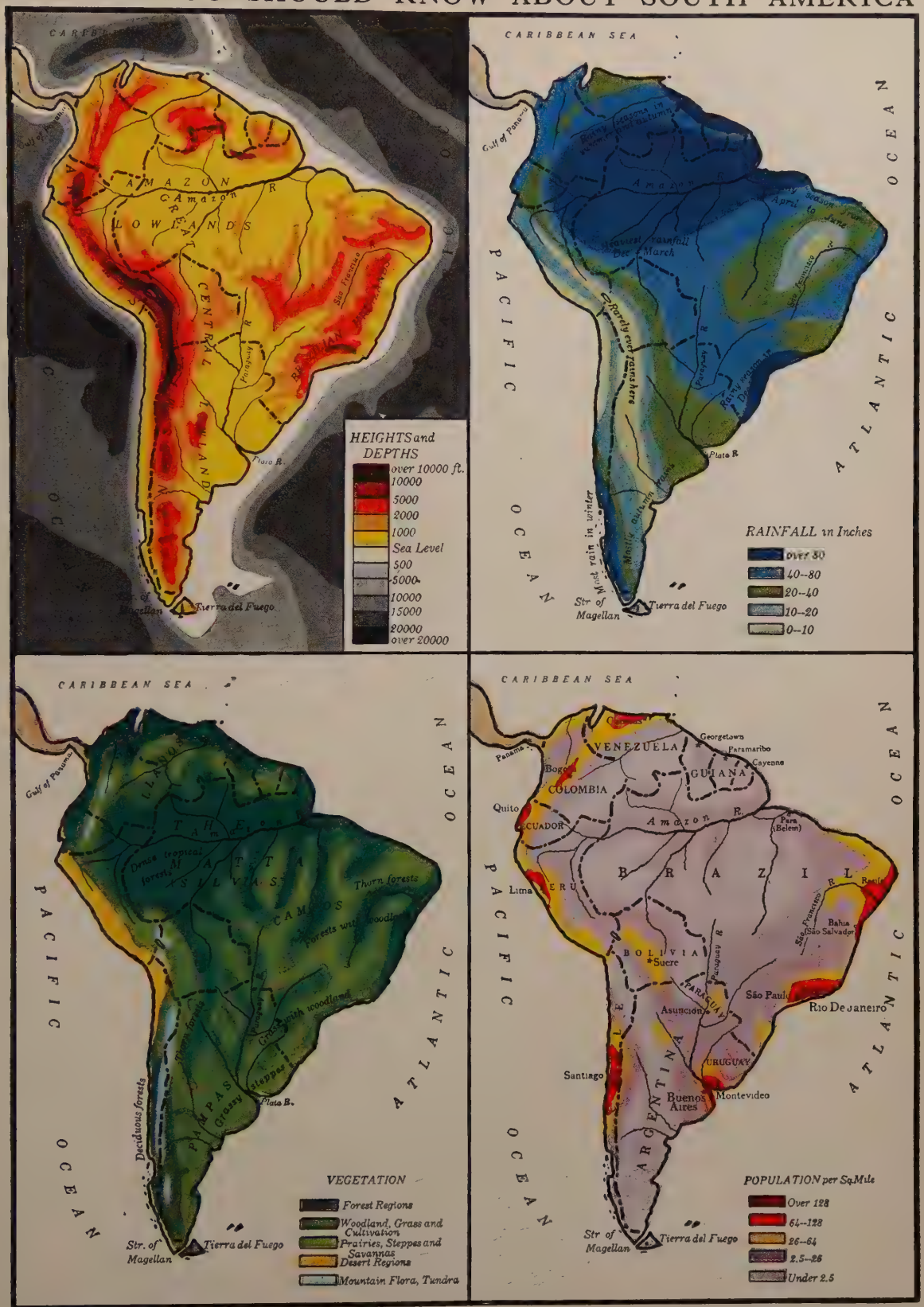
No section of the world holds greater opportunities for the future than South America. Its vast agricultural areas are only awaiting more extensive settlement to double and treble their output. At present there are only 8 people to the square mile, as compared with 35 in the United States. Transportation too is little developed. Most of the people who live in the mountains travel on foot or on mule-back, and freight is carried by llamas. Of recent years, however, South America has been making great strides forward. Every country has at least one railway, some of them involving prodigies of engineering which have excited the admiration of the world. Especially is this true of the Trans-Andean railroad connecting Chile and Argentina, which pierces the Andes by a tunnel at an altitude of 10,000 feet. The whole continent, however,

A BRAZILIAN HOME OF THE FINE ARTS



This building in Rio de Janeiro, the Palace of the Fine Arts, is really a museum. You can see that the public buildings of the large cities of South America are very much like those of North America. The conical pile of rock in the background is the famous Sugar Loaf, 1,200 feet high.

THINGS YOU SHOULD KNOW ABOUT SOUTH AMERICA



Nature seems to have followed, in a measure, the same pattern in building both North and South America. On the west are the young rugged mountains, in the east the old worn-down ranges, with plateaus and lowlands between. Notice how the densest vegetation occurs in the regions of heavy rainfall, and how the most thickly peopled districts are scattered on or near the eastern and western coasts.

SOUTH AMERICA
SCALE OF MILES
0 200 400 600 800 1000
Railroads
C.S. HAMMOND & CO., N.Y.
CARIBBEAN SEA
ATLANTIC OCEAN
PACIFIC OCEAN
VENEZUELA
COLOMBIA
ECUADOR
PERU
BRAZIL
BOLIVIA
PARAGUAY
URUGUAY
GUIANA
BRITISH GUIANA
DUTCH GUIANA
FRENCH GUIANA
Barranquilla
Cartagena
Maracaibo
Puerto Cabello
La Guaira
Caracas
Port of Spain
TRINIDAD (Br.)
Orinoco Delta
Valencia
Ciudad Bolivar
Merida
Georgetown
Paramaribo
Cayenne
Medellin
Bucaramanga
Honda
Atures
Bogota
Antioquia
Buenaventura
Cali
Popayan
Bolivar
Tumaco
Quito
Guayaquil
Cuenca
Iquitos
Chiclayo
Trujillo
Huaraz
Pasco
Callao
Lima
Cuzco
Ayacucho
Ica
Arequipa
Mollendo
Tacna
Arica
Iquique
Tocopilla
Antofagasta
Taltal
Caldera
Serena
Ovalle
Valparaiso
Santiago
Talca
Concepcion
Temuco
Puerto Montt
Ancud
Chonos Archipelago
Gulf of Penas
Campana I.
Wellington
Madre de Dios I.
Strait of Magellan
Santa Cruz
Grande Bay
Punta Arenas
Tierra del Fuego
Mt. Darwin
Staten I.
Wollaston Is.
Cape Horn
Falkland Islands (Br.)
Port Stanley
Obidos
Manaos
Santarem
Para
Braganca
Maranhao
Parnahiba
Granja
Ceara
Aracati
S. Roque
Theresina
S. Francisco
Carolina
Joazeiro
Parahiba
Pernambuco
Alagoas
Penedo
Aracaju
Bahia
Cachoeira
Rio de Contas
Cannavieras
Porto Alegre
Diamantina
Bello Horisonte
Ouro Preto
Victoria
Campos
Petropolis
Rio de Janeiro
Santos
Sao Paulo
Paranagua
Curitiba
Campinas
Desterro
Laguna
Cruz Alta
Rio Pardo
Pelotas
Rio Grande do Sul
Chuy
Montevideo
Villa Rica
Asuncion
Villa Pilar
Corrientes
Jujuy
Tucuman
Rioja
Catamarca
Cordoba
Mendoza
Rosario
Mercedes
Buenos Aires
La Plata
Azul
Tandil
C. Corrientes
Bahia Blanca
General Acha
General Roca
Viedma
Puerto Madryn
Rawson
S. Matias Gulf
Gulf of St. George
C. Tres Puntas
Blanca Bay
Trinidad
Matto Grosso
Cuyaba
Goyaz
Paracatu
Palma
Bomjardim
Santa Maria
Lake Titicaca
La Paz
Sta. Cruz
Cochabamba
Oruro
Sucre
Potosi
Puerto Pacheco
Tarija
Concepcion
Villa Bella
Geral Mts.
Falls of Madeira
Mouths of the Amazon River
Orinoco R.
Amazon R.
Negro R.
Branco R.
Madeira R.
Purus R.
Juruá R.
Javari R.
Ucayali R.
Maranon R.
Beni R.
Mamore R.
Pilcomayo R.
Paraguay R.
Parana R.
Uruguay R.
Tapajos R.
Xingu R.
Araguaya R.
Tocantins R.
Francisco R.
Roosevelt R.
Oyapok R.
Essequibo R.
Demerara R.
Berbice R.
Corantijn R.
Colorado R.
Negro R.
Chubut R.
Deseado R.
Santa Cruz R.
Gallegos R.
Chico R.
Pilcomayo R.
Mt. Illampu
Mt. Illimani
Mt. Aconcagua
Cordillera de los Andes
Cordillera de Merida
Sierra Pacaraima
Sierra Parima
Sierra Tumucumaque
Serra Acarai
Serra Grande
Serra Dos Aymores
Serra Geral
Serra Mantiqueira
Serra Espinhaco
Serra Do Mar
Serra Do Rio Do Rastro
Serra Tapes
Serra Do Herval
Serra Do Caracol
Serra Do Tigre
Serra Do Espigao
Serra Do Cadeado
Serra Do Roncador
Serra Do Norte
Serra Do Urucuia
Serra Da Chapada
Serra Da Natividade
Serra Da Canastra
Serra Da Mantiqueira
Serra Da Bocaina
Serra Da Paranapiacaba
Serra Da Graciosa
Serra Da Boa Vista
Serra Da Esperanca
Serra Da Jaguariahiva
Serra Da Lapa
Serra Da Furquilha
Serra Da Tabatinga
Serra Da Ibiapaba
Serra Da Borborema
Serra Da Baturite
Serra Da Meruoca
Serra Da Ibiapina
Serra Da Tromba
Serra Da Jaburu
Serra Da Jaburuna
Serra Da Jaburuna
Serra Da Jaburuna

has as many miles of railroad as Ohio, Indiana, and Illinois together.

South America abounds in minerals. Most of them are found in the Andes, following along the entire western coast, but many occur in the Brazilian plateau. Since the coming of the Spaniards billions of dollars' worth of silver has been taken from the mines of South America, and this is still one of the most abundant of the metals in the Andes. Gold too is found in many places, although not in remarkable quantities. Copper abounds in Bolivia, Peru, and Chile. The wonderful nitrate deposits in northern Chile for long supplied practically all the world with fertilizer, nitric acid, and iodine, and Colombia furnishes most of the world's emeralds. Diamonds and thorium are found in Brazil; tin, nickel, bismuth, and borax in Bolivia, and vanadium and wolframite in Peru. The asphalt lakes of Trinidad and Bermudez are unparalleled. Coal exists to some extent throughout the Andes, and is mined extensively in southern Chile. With its development will come that of iron, which is found in many places, and with improved transportation will come the exploitation of the many great fields of petroleum. The present mineral and agricultural production of South America gives only a hint of what the future may hold.

A PRESIDENTIAL PALACE IN RIO

This is one of the homes of the President of Brazil. The narrow street, lined with palms, is characteristic of the older part of Rio de Janeiro, but the palace itself shows French and Italian influence.

The mainland of South America was discovered by Columbus, who in 1498 touched at the mouth of the Orinoco. Other navigators shortly followed, among them Americus Vespucius, who published the first account of the New World, and whose name was given to the two continents. The rumor in Mexico of a rich empire to the south aroused the ambition of the Spaniards, and caused Pizarro to enter Peru with a few hundred followers. Here he discovered the Incas, a people highly skilled as masons and metal workers, and in possession of rich silver mines. Finding the kingdom in the throes of a civil war, the Spaniards had little difficulty in making it their own. With their appetite whetted by the silver of Peru, other Spaniards spread to the north and south from that country. In 1693 rich gold deposits were discovered by the Portuguese in Brazil. In the footsteps of the explorers came Catholic missionaries, baptizing the natives and erecting missions where they might teach them. As a result, not only the upper classes of South America but the Indians as well are Catholics today, and the church has played an important part in political affairs.

With the exception of Brazil, the greater part of South America was under the rule of Spain for some 300 years after the sailing of Columbus. In 1810, inspired by the successful example of the United States, and aided by Napoleon's seizure of Spain, the colonies began their Wars of Emancipation. The enthusiasm of Simon Bolivar (1783–1830) and the heroism of José de San Martin (1778–1850) helped bring them to a successful conclusion before 1825. Each group became gradually independent, and republics were formed with governments modeled after that of the United States. Brazil, which had severed its connection with Portugal in 1822, remained an independent empire until a revolution in 1893 made it too a republic. The Guianas are now the only places on the mainland remaining under European control. For many years the South American states were disturbed by dictatorships and revolutions, but the governments have gradually become more stable, especially in the larger countries. In international affairs South American countries have recently shown a tendency to submit their disputes to arbitration and were among the first to join the League of Nations. The United States in the conduct of its diplomacy and through agencies such as the Pan-American Union is making progress in promoting friendliness and commercial coöperation with South America.

(For detailed accounts of the various countries, *see* separate articles on Argentina, Brazil, etc.)

SOUTHAMPTON, ENGLAND. At the head of Southampton Water, one of the finest natural harbors of England, with the Isle of Wight standing guard at its entrance to the English Channel, the city of Southampton is primarily concerned with the trade of the British Empire. From its 300 acres of docks much of Great Britain's import trade travels by railway 70 miles northeast to London; and exports of cotton, linen, woolen, worsted, and leather goods, machinery, and hardware start on their long journey to the West Indies and the Pacific (via Panama), to Brazil, to South Africa, to New York, to Cherbourg and Havre across the Channel to the south, and to Dublin, Belfast, and Glasgow. It is also an important port for passenger steamers.

The city lies between the rivers Itchen and Test much as if it were on a peninsula. In ancient days there was a Roman walled town on the east bank of the Itchen, but probably about the 11th century, at the time of the Danish invasions, the present site on the west bank became the important part of the community. From the earliest times its strategic position, both for trade and for military operations, has given it importance, and ruins of the old Roman and Saxon fortifications may still be seen.

The modern town, with its great harbor, owes its prosperity largely to railway connection with London, established in 1840. Miles of quays and dry-docks line the extensive water-front. The harbor has the unusual advantage of a double tide, coming in through the two inlets behind the Isle of Wight with two hours' difference in time, thus prolonging high water for two or three hours.

The Isle of Wight at the harbor mouth is a charming spot with chalk cliffs, ravines, and green pastures. It is a much visited resort, and here Queen Victoria often stayed. She died at Osborne House, near Cowes, the little port off which the great English yacht races are held. Population of Southampton, about 161,000.

The PALMETTO STATE—*"Keystone" of the* SOUTH

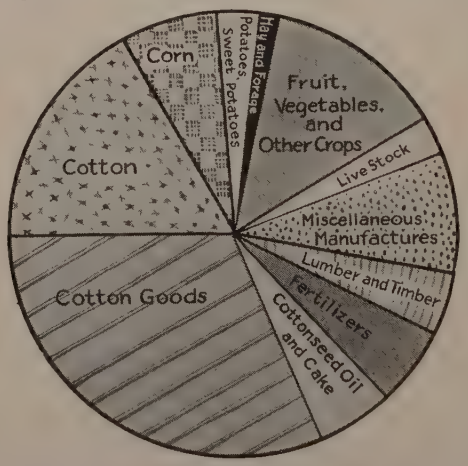
SOUTH CAROLINA. Shaped like a blunt wedge, with its base lapped by the Atlantic Ocean and its point thrust into the Appalachian Mountains, South Carolina has been called the "keystone" of the South Atlantic seaboard. And it is that in more than one sense; for when it broke loose from the Union, in 1860, the whole nation tottered and seemed for a while to be near disaster. Devastated by Sherman's march northward from Georgia in 1865, and forced after the war to face entirely new social and economic conditions, it was many years before the state regained the prosperity which its great cotton and rice plantations had given it under slavery. But with a matchless climate and a soil that will produce almost all the crops common to the different portions of the United States, the "Palmetto State" has advanced steadily in the new era. It ranks among the first two or three states in cotton growing; and the tremendous water-power of the mountain regions has also been utilized, together with an available labor supply, to produce a wonderful development in manufacturing, especially of cotton goods. In a short time South Carolina has leaped to a high place among the states in cotton textile manufactures, now being surpassed only by Massachusetts and North Carolina.

Extent.—North to south, greatest distance, 220 miles; east to west, 270 miles. Area, 31,000 square miles. Population (1920 census), 1,683,724.

Physical Features.—Over 200 miles of Atlantic coast-line forming the southeast boundary, and broken by islands and salt marshes in the southern part; low coastal plain rising to the piedmont region; Blue Ridge in the extreme northwest (Sassafras Mountain 3,548 feet). Principal rivers: Great and Little Pedee, Santee (tributaries, Wateree, Broad, Saluda), Edisto, and the Savannah, the latter forming the boundary with Georgia.

Products.—Cotton, corn, oats, hay, potatoes and sweet potatoes, other vegetables and fruit, tobacco; live stock; fish; phosphate rock, clay, granite; lumber and timber; cotton goods, cottonseed oil and cake, fertilizers.

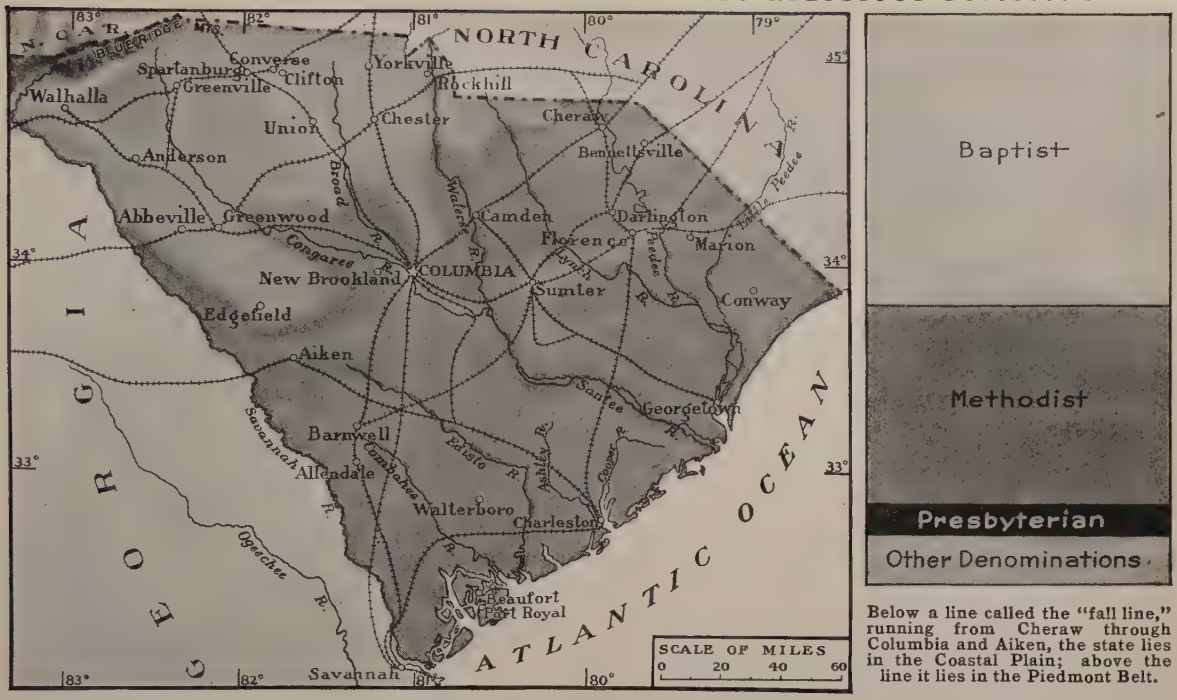
Chief Cities.—Charleston (70,000), Columbia (capital, 38,000), Greenville and Spartanburg (about 25,000).



You can see from a glance at this products chart how cotton and cotton manufactures predominate among the sources of South Carolina's wealth.

Few states afford a more interesting study in physiography than South Carolina. From marshy coastal lowlands, fertile interior alluvial plains, sandy highlands, rolling hills and low mountains, the land rises in a series of gradations from the Atlantic Ocean to the southern spurs of the Appalachians. The eastern two-thirds of the state is called "low country," or the coastal plain. The west is the "up-country," or piedmont plateau, the most thickly populated region. This region is supreme in both manufacturing and agriculture, having abundant water-power and rich well-watered soils. Dividing these two great sections is the "fall line," which was the old shore of the State when the piedmont plateau was the only part of the Atlantic coast above water. The many rapids on this line are the source of water-power; and since it also marks the head of navigation, important cities, including Camden and Columbia, are situated on the rivers at this point. The third section of the state is the Appalachian

THE SURFACE OF SOUTH CAROLINA AND ITS RELIGIOUS DIVISIONS



Below a line called the "fall line," running from Cheraw through Columbia and Aiken, the state lies in the Coastal Plain; above the line it lies in the Piedmont Belt.

range, in the extreme northwest, where is found the highest point in the state, Sassafras Mountain (3,548 feet).

"Cotton is king" in a double sense today in South Carolina, and cottonseed is "crown prince." The products of the cotton plant are predominant not only in agriculture but in manufacturing and commerce as well. The longest, finest, and most valuable fiber in the world is produced on the famous Sea Islands; and on the mainland, from the seacoast to the mountains, cotton is produced in every part of the state. South Carolina no longer devotes all its acres to one crop, however. The destructive boll weevil has taught the people the advantages of diversified farming, and other crops are receiving more attention every year, until corn now bids fair to rival cotton in both acreage and value. Millions of dollars' worth of garden truck is produced annually to be sent to the great northern cities, including cabbages from the largest cabbage farm in the world, potatoes, and other vegetables. Oats and hay are also raised, instead of being bought from other states, and tobacco is an important crop. Stock-raising and dairying thrive, and are steadily increasing. In the growing of rice, however, South Carolina no longer bears the palm. Because of the difficulty of using modern machinery on its undrained lowlands, Louisiana, Texas, and several other states greatly surpass the state which introduced the industry into America.

A PIT OF HIGH-GRADE KAOLIN

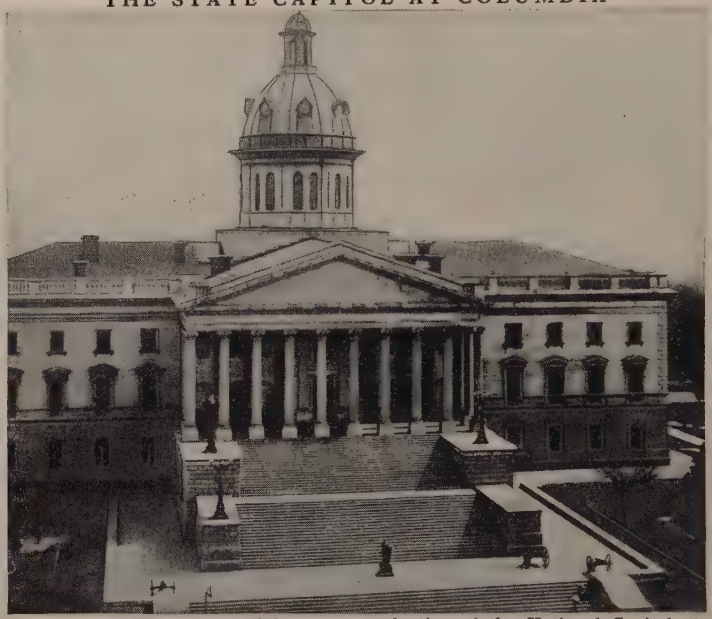
Clay of various grades is found in nearly all parts of the state, but the most important are the deposits of kaolin, which is used in the manufacture of pottery. Kaolin deposits are worked like ordinary clay pits.

Cotton goods and cottonseed oil and cake constitute almost 70 per cent of the total value of South Carolina's manufactured products. The development of the cotton industry has been remarkably rapid. Cotton mills utilizing much of the water-power have sprung up one after another all over the piedmont section of the state, giving rise to new towns and bringing prosperity to old ones. The fertilizer industry has also grown immensely, utilizing the waste from the cotton seeds and the large deposits of phosphate rock which lie in several counties. Third in rank among the state's industries are lumber and timber products. Great forests of Southern pine (estimated at 3,000 million feet) abound in the

coastal region, cypress is found in the swamps, and hardwoods on the hillsides in the piedmont section. On the coast fishing is of some importance, thousands of bushels of oysters being canned annually.

With the exception of phosphate rock, of which South Carolina was for many years the leading producer, little mining is done in the state. There is, however, an abundance of granite in some places, and large quantities have been quarried for building and monumental work. Clays for brick and tile are found in practically all sections and there are extensive deposits of high-grade kaolin, which is shipped to other states for use in making pottery.

THE STATE CAPITOL AT COLUMBIA



This granite building, a miniature reproduction of the National Capitol at Washington, is one of the most imposing structures in the South and one of the handsomest of all the state capitols.

The largest city and most important seaport and commercial center in South Carolina is Charleston (*see* Charleston). In the center of the state is Columbia, the capital, which was destroyed by a fire in the Civil War but is now one of the handsomest cities of its size in the country. Picturesquely situated on the level top of a bluff, it overlooks the Congaree River, which, plunging down in many rapids, affords abundant electricity for the city's use. Cotton manufacturing is the most important industry, but there are also glass works, granite quarries, and a large lumber industry. There are many educational institutions, of which the University of South Carolina is the most important; and a State House which is one of the most imposing in the country.

Greenville and Spartanburg, at the foot of the Blue Ridge Mountains, are other thriving cotton-manufacturing centers, situated in some of the finest cotton country and general farming lands of the state. There are also iron works and various other manufactures in this region.

Early Government Was of Feudal Type

The first settlement attempted in South Carolina was made in 1562 by a body of French Protestants, who named the place at which they landed Port Royal, "because of the fairness and largeness thereof." This colony was, however, shortly abandoned. In 1663 Charles II of England made over to eight of his lords and gentlemen the provinces of "Carolina," which two years later was defined to include the whole of the present Carolinas, Georgia, and much of Florida, and extended east and west "from sea to sea." Among these "proprietaries" were the Earl of Clarendon and Sir Anthony Ashley Cooper (later made Earl of Shaftesbury), from whom the Ashley and Cooper rivers were named. In 1669 this proprietary board adopted for the colony an elaborate system of government, based on feudal principles and drawn up by the philosopher John Locke. Though greatly modified in actual operation, this constitution encouraged the plantation system and a slaveholding aristocracy.

The first permanent English settlement was Charleston, established in 1670 on the west bank of the Ashley River. In 1680 it was moved to the east bank, between the Ashley and Cooper rivers, which is the present site of the city. Before the Revolution the colony was so prosperous that a visitor said of it, "It far surpasses all I ever saw or expected to see in America."

South Carolina suffered severely during the American Revolution. In 1780 Charleston was captured, and the colony was overrun by British troops; but the tide turned at Kings Mountain, when a force of 1,100 was surrounded and forced to surrender, and at the battle of Cowpens one of the Cornwallis corps was practically destroyed. The British were then driven back until they held only Charleston.

Under the Federal Constitution South Carolina became the leader of the South, as Massachusetts was of the North. Through its able spokesman, John C. Calhoun, the state became the principal exponent of state sovereignty and took an active part in the events which finally led to the Civil War. In that struggle South Carolina was the first to secede and opened hostilities by the attack on Fort Sumter. The state suffered heavily during the war and also in the reconstruction days which followed.

When President Hayes withdrew the Federal troops in 1877, the era of "carpet-bag" control, with its terrible extravagance and corruption, came to an end. Charleston suffered from a violent earthquake Aug. 31, 1886, and a widespread storm along the coast cost more than a thousand lives in 1893.

TOKENS OF WEALTH IN SOUTH CAROLINA

Tobacco of Long Fame
World's Largest Cabbage Farm
Her Waters Generate Much Power
Backbone of the State's Industry—Cotton and its Manufactures
Increasing Live Stock and Dairying Interests
Millions of Acres of Corn
Great Forests of Yellow Pine, Cypress and Hardwoods
University of South Carolina, Columbia

In these pictures of South Carolina's leading products and industries, we see how handsomely Nature has favored the state. From the rich fields, South Carolina obtains a long and varied list of products, of which tobacco, corn, and cabbages are conspicuous examples. The forests yield a wealth of timber, and the harnessed streams give power that is used in the cotton mills and elsewhere. The excellent university at Columbia is one of the many institutions supported by the state's prosperity.

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ON SOUTH DAKOTA'S ROLLING PRAIRIES

Extent.—East to west, 380 miles; north to south, greatest distance, 225 miles. Area, 77,615 square miles. Population (1920 census), 636,547.

Physical Features.—Rolling plains broken by the Bad Lands of the White River and the Black Hills in the southwest (highest point, Harney Peak, 7,242 feet). Principal rivers: Missouri River and its tributaries, the Big Sioux, James, Grand, Moreau, Cheyenne, and White.

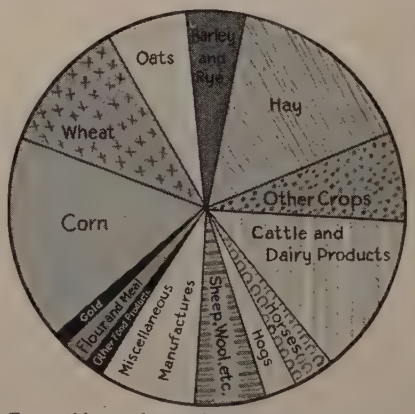
Products.—Wheat, corn, oats, rye, barley, hay, flax, and potatoes; cattle and dairy products, swine, horses, sheep and wool; gold, tungsten ore, silver, stone, etc.; flour, meal, and other food products.

Chief Cities.—Sioux Falls (about 26,000), Aberdeen (15,000), Pierre (capital).

SOUTH DAKOTA. Save for an uplifted area nearly as large as New Jersey in the southwest corner of the state, South Dakota is a vast rolling plain, a part of the great Mississippi valley which stretches in unparalleled richness from the Alleghenies and the Great Lakes to the Rocky Mountains. It is divided into two fairly equal parts by the great Missouri River, yellow with silt, which traverses the state from the center of the northern boundary just below the 46th parallel to the Nebraska line, where it veers to the southeast to form part of the state's southern boundary. The pioneer always described his location as east or west of "the river." And not all its railways and motor cars, nor yet rural free delivery, will ever do away with this distinction. For the two halves of the state are very different—topographically, in their history, and in their growth.

"East of the river" is rich prairie land, like Iowa and Illinois. Its drainage is from north to south, in the valleys of the James and the Big Sioux, which flow into the rapid Missouri. With practically the normal rainfall of the Mississippi valley it is a land of prosperous farms, at almost "Iowa prices" per acre. Seven of South Dakota's nine cities having a population exceeding 3,000 are located in this region.

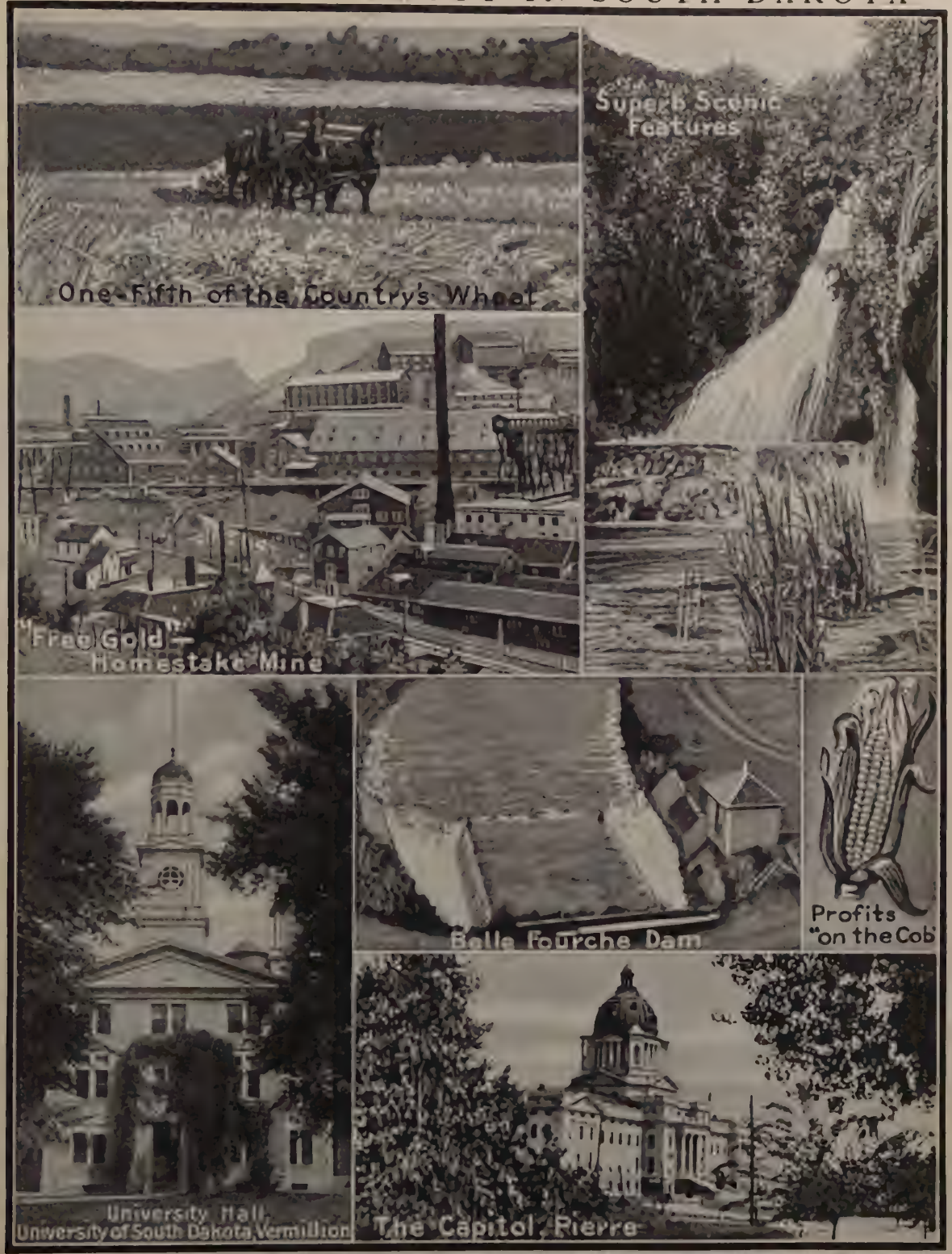
The "west of the river" country is part of the Great Plains—vast level stretches broken by occasional clusters of low hills and cut into deep ravines by every stream, big and little; treeless save for clumps of oak, elm, and cottonwood along its scattered waterways. Much of it is the open country, the land of great ranches feeding thousands of heads of cattle. Sheep-grazing, which was expected to be the salvation of the semi-arid northwestern section, has been largely abandoned since the government built the Belle Fourche Dam, irrigating 100,000 acres to the northward, and westward to the Montana and Wyoming line. Only in the "movies" is the cowboy still seen in this region, for the settling of this country, homesteading especially, has largely broken up the limitless unfenced reaches of public domain, which was open "range" in the days gone by.



From this products chart you can see how large a proportion of South Dakota's wealth comes from its farms and ranches.

The Black Hills district, in the southwest, is a picturesque district about 125 miles long and 60 wide, heavily timbered except on its eastern edge, and a maze of low ridges, deep rock canyons and ravines, and rapid streams. In coloring and fascination it is unique, a region surpassed in beauty by very few parts of the United States. Many persons, indeed, think Spearfish Canyon, near Deadwood, quite the equal of Switzerland in scenic charm. Four-fifths of the 2,500 square miles of timber land in the state are in the Black Hills. In normal years the annual rainfall is sufficient for farming throughout the region, and in even extremely dry seasons the cultivator of the floors of the deep winding valleys gets a paying crop. Game and fish are plentiful. Cold springs abound. Hot springs are numerous in the south-

WEALTH AND BEAUTY IN SOUTH DAKOTA


One-Fifth of the Country's Wheat
Superb Scenic Features
Free Gold—Homestake Mine
Belle Fourche Dam
Profits "on the Cob"
University Hall, University of South Dakota, Vermillion
The Capitol, Pierre

When you think of South Dakota, you think of wheat—and rightly so, for this state is one of the world's greatest wheat-producing regions. But wheat by no means exhausts the story. The state also obtains wealth from corn and other agricultural products, and has mineral deposits, of which gold is the most important. The state also has its charming aspects, as the picture of Roughlock Falls in Spearfish Canyon testifies. Belle Fourche Dam is a great irrigation project, while the Capitol and the university building are typical of the public institutions.

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ONCE FAMOUS FOR "BAD LANDS," NOW FOR GOLD AND GRAIN

The map shows clearly how the Missouri River divides the state into two parts of almost equal area. West of the river the drainage is eastward; east of it, southward. At the right you see how the various religious denominations rank in numbers.

eastern spur, where the Federal government has set aside a tract of 17 square miles as the Wind Cave National Park. The great cavern which gives its name to the park contains many miles of galleries, once the channel of subterranean streams. In one corner of the park is a game preserve with herds of bison, elk, and antelopes.

Between the Hills and the White River lie the famous "Bad Lands." Here Nature, by the erosion of a stratified sandstone plain, has built a strange labyrinth of tall columns and pinnacles, bare toadstool-like tables bearing no vegetation except buffalo grass or "blue stem," contrasting vividly in color with the soft grays, creams, and rose of the supporting clay. This weird formation follows the north side of the White River for 120 miles, varying in breadth from 30 to 50 miles.

The climate of South Dakota, so far from both oceans, is continental in character and subject to great extremes of heat and cold. In the Black Hills, which give shelter from the prevailing northwest winds and storms, a milder condition prevails.

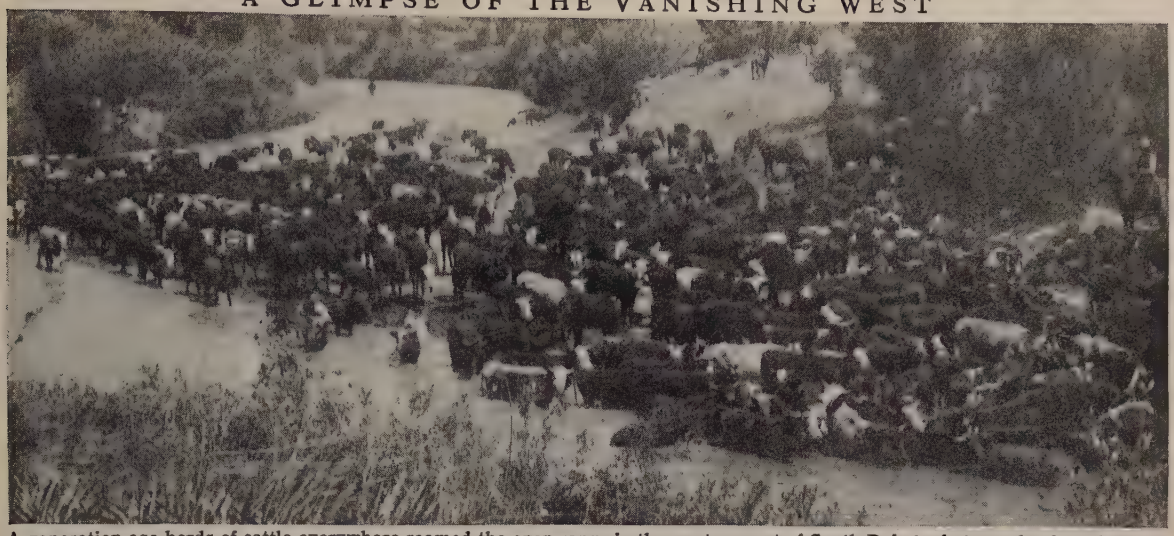
Pierre, the capital, is almost exactly in the center of the state, on the Missouri River. Attracted by the reports of the Lewis and Clark expedition of 1804–06, the American Fur Company established a trading post at Pierre in 1832. But growth has been slow, and despite its state house and other public businesses, its natural gas and thriving cattle market, Pierre still counts less than 4,000 inhabitants. Sioux Falls and several nearby colonies made a start in the 1850's but their development too was retarded, first by the Civil War, and then by Indian uprisings led by Spotted Tail, Red Cloud, and Sitting Bull, throughout the period 1863–76.

The great Sioux reservation in the center of the state—then a little larger than the state of Maine—long blocked the way for men from eastern settlements who had visions of the wealth to be gained in this fine cattle country. It seemed necessary to break up the reservation, and the white man has snipped and snipped—11,000,000 acres once, smaller tracts from time to time—until now only about 1,400 square miles, comprised in six scattered reservations, remain to the Indians. The chief of these today is the Pine Ridge reservation, on the southwestern border of the state, where Sitting Bull and his Sioux were placed after their last bloody outbreak in 1876. In all some 20,000 Indians, mainly Dakota and Sioux, now inhabit the state.

In 1874 a surveying party for the Northern Pacific Railway went into the Black Hills under the protection of Gen. George A. Custer of the United States Army. Miners at that time discovered gold at French Creek, in the south part of the Hills, and later in the district now made famous by the great Homestake Mine, at Lead. The Indian cession of their right to the Black Hills country, in 1876, was splashed with crimson in the historic massacre of Custer and his men in the Little Big Horn country in nearby Montana. (*See* Indians, American; Montana.)

For ten years after the discovery of gold, little headway was made in developing the mines. Then the Chicago & Northwestern Railway extended its line north as far as Buffalo Gap, a deserted village now but then a Wild West town, where "Deadwood Dick" and his ilk did a thriving business. Here began the stageline which carried mail, provisions, and eager prospectors to the latest bonanza, and brought thence gold and broken lives and hopes.

A GLIMPSE OF THE VANISHING WEST



A generation ago herds of cattle everywhere roamed the open range in the western part of South Dakota, but now herds as large as this one, brought to water in the Bad River near Pierre, are not so common. The range has been broken up by settlement, and the homesteader's fence long since restrained the cowboy and his herds.

The Homestake Mine is still perhaps the largest and most easily worked mass of low-grade ore in the world. The ore has only to be crushed, and its "free gold" is easily extracted by the cyanide process, several hundred tons being put through daily. Gold is found in small quantities elsewhere in the Hills, and also extensive deposits of mica, gypsum, and lignite (low-grade coal). Silver, copper, lead, tungsten, and lithium are also found; and in the central part of the state, along the Missouri River, are a number of natural gas wells.

Fourteenth state in the Union in point of area, being nine times the size of Massachusetts, and with a population 90 per cent rural, South Dakota can boast only two cities—Aberdeen and Sioux Falls—which pass the 15,000 population mark. One-sixth of the population is foreign born, chiefly from northern Europe—Scandinavia and Russia. The state is usually third or fourth in its output of gold and barley, third in the production of hard spring wheat, and stands high in the value of its corn and rye. Its prosperous cultivators of the soil own motor vehicles at the rate of one for every eight persons, which is better than rich Illinois does, with one for every ten. All in all this is not a bad record for a young state which was not admitted to the union until 1889, nor even organized as a territory—with its northern sister—until 1882.

Soy bean. For building up the soil and at the same time yielding a valuable crop for seed or feed, the soy bean is rapidly becoming a favorite with the American farmer. Like other leguminous plants, it assimilates nitrogen from the air, and so enriches the soil in which it is planted. It grows as far north as corn, and in soil that is too hard for clover.

When plowed under, a crop of soy beans greatly improves the soil. It is used for hay, silage, or green fodder, and the beans are ground and mixed with other stock feed. When grown for seed the crop yields 40 bushels or more an acre. The beans contain from 16 to 21 per cent of oil, which is used for cooking, soap-making, and other industrial purposes. The "cake" remaining after the oil has been extracted is extensively used as cattle-feed in northern Europe and in the United States.

In Asiatic countries, where rice is largely eaten, the diet is balanced by the consumption of large quantities of foods made of soy beans, which contain sufficient protein to take the place of meat and other costly nitrogenous foods. The soy bean is made into various food products. The four principal ones are bean curd, soy sauce, oil, and sprouted seeds. Soy sauce or *shoyu*, which is very popular in China and Japan, is prepared from a mixture of boiled soy beans fermented in the hot sun for weeks; salt is added to the resulting liquid. In the United States flour made from the soy bean is sometimes made into bread for persons affected with diabetes, and the bean itself is being increasingly used as a substitute for its higher-priced relative, the navy bean.

The soy bean has been cultivated for many centuries in the Far East. It was introduced into England in 1790, and some years later into America. It is a bushy upright plant, two to four feet tall, and has branching hairy stems and three-parted hairy leaves. The flowers are inconspicuous, and the broad pod is covered, like the rest of the plant, with stiff, reddish hair.

The scientific name of the soy bean is *Glycine hispida*. Upward of 200 varieties are grown in China and Japan, every district having its distinct varieties. These differ mainly in the shape, size, and color of the seed, the degree of hardness of the plant, and the length of the growing season.

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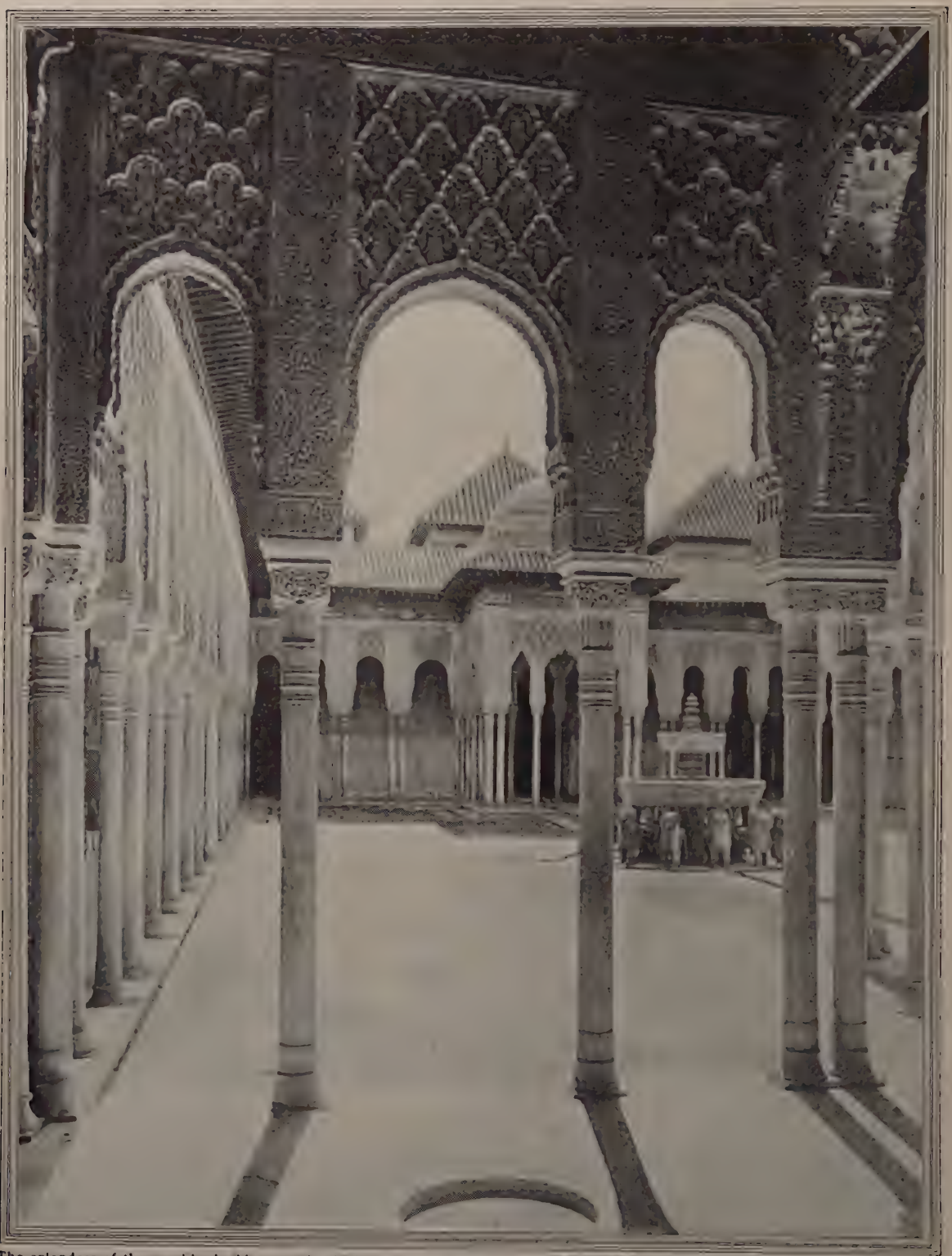
A MEMORIAL OF MOORISH RULE IN SPAIN



The splendors of the gemlike buildings with which the Moors adorned Spain in the Middle Ages are still preserved for us in the slender columns, the delicate and intricate tracery, and the time-mellowed tints of the ancient Moorish palace and fortress of the Alhambra, in the city of Granada. Built in the 13th and 14th centuries, this was the last stronghold of the Moors in Spain, falling into the hands of Ferdinand in 1492. Of its many superb halls and courts perhaps the gem is the Court of Lions, pictured above, with its 124 columns surrounding the beautiful alabaster fountain, which is supported on the backs of twelve marble lions.

For any subject not found in its alphabetical place see information

ROMANTIC SPAIN — *Once* MISTRESS *of* HALF *the* WORLD

Street Dancers of Granada, with the Alhambra in the Distance

SPAIN. Barren wind-swept plateaus, snow-capped mountains, a few wonderfully fertile strips of lowland along the blue Mediterranean; narrow rushing rivers with long names but little water; Moorish palaces and bright gardens where grow vines, olives, pomegranates, oranges, and tropical flowers; a land of splendor and tatters, trailing romantic memories of the Moors, of the Cid and his knights, of Columbus and the many other gallant adventurers who made Spain mistress of half the world and dotted the Atlantic with gold-bearing galleons from America and the Indies—this is Spain.

Extent.—East to west, greatest distance, about 650 miles; north to south, about 550 miles. Area, 190,050 square miles; with Balearic Islands, Canary Islands, etc., 194,783 square miles. Population, about 21,000,000. Colonies (in Africa), 128,149 square miles; population, 845,000.

Physical Features.—Pyrenees, separating Spain from France; Cantabrian Mountains, Sierra de Guadarrama, Sierra de Gredos, Sierra de Gata, Montes de Toledo, Sierra Morena, dividing and bounding the central plateau; Sierra Nevada to the south (highest point, Mulhacen, about 11,420 feet). Chief rivers, the Ter, Llobregat, Ebro, Guadalaviar, Jucar, and Segura, flowing into the Mediterranean; and the Minho, Douro, Tagus, Guadiana, and Guadalquivir, flowing into the Atlantic Ocean.

Products.—Wheat, barley, other cereals, cotton, sugar cane, vegetables, grapes and wine, olives and olive oil, oranges and other fruits, nuts; silk; sheep and goats, wool, other live stock; sardines, tunny fish, codfish; coal, lead, iron, copper, mercury, silver, salt; cotton and woolen goods, paper, corks, glass, sugar, leather goods, tobacco products.

Chief Cities.—Madrid (capital, 650,000), Barcelona (622,000), Valencia (245,000), Seville (165,000), Malaga, Murcia, Saragossa, Cartagena, Bilbao (over 100,000).

Nothing strikes the traveler more forcibly than the backwardness of present-day Spain compared with the other great nations of Europe. He will often see a farmer scratching his land with an iron-shod stick for a plow. He will notice donkeys bearing loads of brush twice their size, and lonely charcoal burners' huts; then as he leans over a brazier in a chilly hotel which ought to have steam heat, he will wonder why Spain does not use its vast beds of coal.

Yet of late years a new Spain has been appearing. Jolted out of its sleep of centuries by the Spanish-American War, which stripped it of almost the last remnants of its once great colonial empire, Spain is improving its roads, its schools, its agricultural methods. And still more recently, its neutrality in the World War of 1914–18 gave Spain a chance to catch up with the rest of Europe, and to develop its resources.

It has been said that Europe ends at the Pyrenees Mountains and there Africa begins. Spain, now separated from Morocco only by the narrow strait of Gibraltar, was until late geological times united with it. In its formation as well as in its people the Iberian peninsula suggests the northern coast of Africa. Here is the same smooth coast-line, whose indentations, apart from the fiordlike inlets along the Bay of Biscay to the north, and around the northwest corner where Spain touches the Atlantic, might almost be numbered on one hand by enumerating the little bays of Cadiz, Algeciras, Malaga, and the harbors of

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THE MOUNTAIN-STUDDED LAND OF SPAIN

The map shows the historic names, such as Castile and Leon, which designate specific regions, as well as the principal cities and mountain ranges.

Barcelona and Cartagena (Spain's principal naval arsenal and dockyard). Spain too has a central plain, high, mountainous, and dry, where long mule trains plodding across the waste suggest the Sahara, and there is also the fertile rim studded with flourishing cities and beautiful gardens.

In visiting Spain you will not need to save much of your time for the central table-land, which—rising to an average height of nearly 2,700 feet, and punctuated by toothlike mountain ranges or sierras—occupies over half the actual area of the land. None of the great cities are there, except Madrid, the capital, and a few whose interest is chiefly historic. Toledo, the "hundred-towered" city, on its rock surrounded on three sides by the "golden" River Tagus, and on the other by medieval fortifications, presents long lines of palaces and convents terraced around the rocky slope, a sheaf of belfries piercing the sky, and the huge cube of the Moorish Alcazar on the topmost crest. Although no longer the capital of a kingdom, as it was under the Visigoths, Toledo is still the church capital and seat of the primate of all Spain. Saragossa, once the capital of the kingdom of Aragon, is a flourishing modern city. Like Toledo, it has its Gothic cathedral and its Moorish castle, and boasts a university founded in 1474. Salamanca, on the Tormes River, is the oldest and most famous of Spain's university towns, and the one which introduced Arabic learning into Europe. Burgos, at the foot of the mountains to the north, is dominated by its Gothic cathedral, the most elaborate in all Spain, and by its romantic memories of that famous Spanish warrior the Cid, who had so many successful encounters with the Mohammedan Moors.

The chief industry of this dreary plateau is represented by the sheep that roam all summer long in flocks of 10,000 tended by shepherds dressed in sheepskin jackets and leather breeches. Scarcely a tree is to be seen in these regions, for ruthless deforestation, practiced through the centuries, has stripped all but six per cent of the land of the great forests which once covered it. Treeless, windswept, dusty, exposed to great extremes of cold and heat, this plateau is one of the most thinly populated sections of Europe.

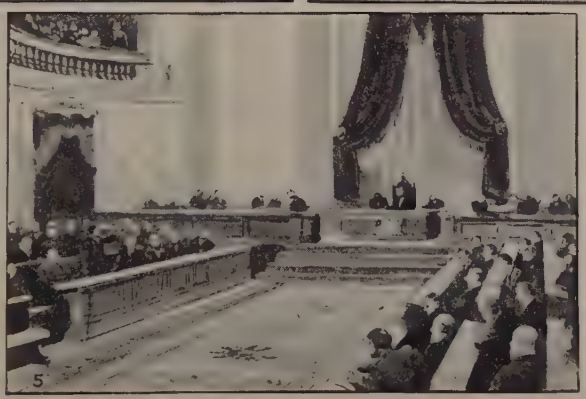
But the coast regions of Spain tell a different story. There you will find numerous large cities and active industries. If you cross the Pyrenees from France at the west—there are now railways at both ends—you will come out on the lands bordering the Bay of

SPANISH MULES AND THEIR PACKS

As in other mountainous, industrially backward countries, the sure-footed mule is an important factor in the internal trade of Spain. These patient beasts carry loads larger than themselves.

FIVE DRAMATIC MOMENTS IN SPANISH HISTORY

After enduring nearly seven and a half centuries, Moorish rule in Spain ended in 1492 with the surrender of Granada to Ferdinand of Aragon (1). As Boabdil, the last Moorish king of Granada, turned to take his last look at the city, he burst into tears. "Right my son," tauntingly exclaimed his mother, "weep like a woman for the throne which you had not the spirit to defend as a man and a king!" That same year Columbus set out on the voyage which ended in the discovery of the New World. In the next picture (2) we see him on his return in 1493 showing Ferdinand and Isabella the trophies of his bold expedition. Under Charles V, who ruled Germany, the Netherlands,



and Naples and Sicily, as well as Spain, Spanish power reached its height. The third picture shows Pizarro, the conqueror of Peru, winning the approval of Charles for the projects which added enormous conquests to Spain's possessions in the New World. After Charles V, Spain's star declined. With the defeat in 1588 of the Great Armada (4), her sea power was broken and the flood of treasure which had been pouring in from the New World gradually ebbed. But the autocracy which had brought Spain so low was ended in 1812, when the Cortes (5) enacted a constitution, and a better day rounded on democratic ideals began to dawn.

Biscay, which are the wettest in Europe, just as those on the central plateau are the driest. The air is mild all the year round and roses bloom at Christmas as in midsummer. Here is a scene of active coal and iron mining. The three Basque provinces alone, nestling at the foot of the Pyrenees, produce annually more than half the iron that is mined in Spain. And they have other active industries—grape-growing for wine, apples for cider, and fishing; and if the chief catch of the intrepid Basque fishermen is now the sardines that they find in their "rias" or fiordlike inlets, it is only because whales have disappeared from this neighborhood.

The Basques themselves are a mysterious people, about whose origin scholars have long been speculating. Their racial characteristics distinguish them even when they migrate with other Spaniards or Frenchmen to America, and their language differs from neighboring tongues not only in its words but in the very type of its grammar. Most students believe that the Basques are a remnant of a pre-Indo-Germanic race that the Greeks and Romans found in Spain and called Iberians. The Basques in France and Spain today number about 600,000.

If you cross the Pyrenees at their eastern end, you come upon Barcelona and other densely populated coast towns, where manufacturing, particularly the weaving of cotton, goes busily on. The Balearic Islands, lying obliquely off this coast, are a center for the manufacture of shoes.

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Farther south on this coast lies the great garden region of Spain, centering in Valencia. The climate is hot and dry almost beyond human endurance, but by means of irrigation channels introduced centuries ago by the Moors, the fertile soil is made to yield in tropical luxuriance grains, sugar-cane, oranges, lemons, citrons, figs, dates, pomegranates, tomatoes, melons, and grapes. Mulberries, too, grow here in abundance, making Valencia the chief seat of the Spanish silk culture and manufacture.

THE GRAY OLIVE GROVES OF THE SPANISH HILLS

The broad-leaved olive trees of Spain yield larger fruit than those of France and Italy, though the oil is less delicate. It is believed that the Phoenicians introduced the olive into southern Spain.

The Regions of which the Poets Sing

The southern provinces of Spain, known as Andalusia, form the beautiful region of which poets sing. Here lies the picturesque Moorish city of Granada, the splendid capital of the Moorish province which held out for 200 years after the Moors had been driven from the rest of Spain. It was once a city of 400,000 inhabitants, but now is reduced to less than one-fourth that size. Its chief glory is the palace of the Alhambra, the most perfect relic of Moorish art. (*See* Alhambra.) Cordoba, in Moorish times one of the greatest commercial centers of the world, is still famed for its Cordovan leather and olive oil. Cadiz, said to be the oldest town of continuous existence in Europe, was founded about 1100 B.C. by the Phoenicians under the name of Gadir. It remained an important city for thousands of years, having its final burst of splendor in the 18th century, when it held the monopoly of trade with Spanish America.

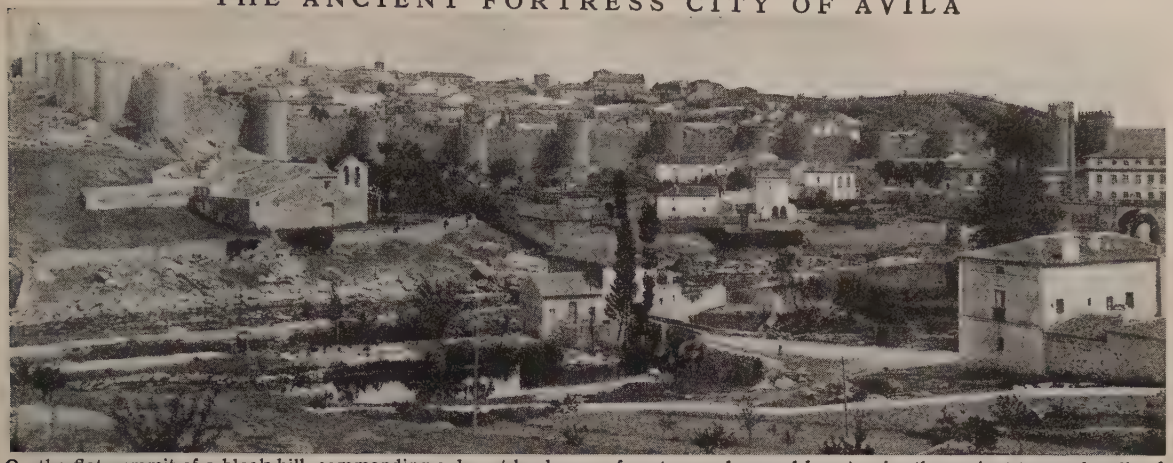
The south of Spain is also the country of famous wines, malaga and sherry (named from Jerez), although wine is to a great extent an industry of all the 49 provinces. Even the central plateau in places is irrigated for grape-growing. In these tropical regions you will everywhere see lizards, sometimes three feet long, and scorpions, and you may walk through stately forests of cork oak whose bark is one of the chief products of the country.

Next to agriculture, mining is the greatest source of Spain's wealth. Its mountains yield an astonishing variety of minerals, leading all Europe in copper, lead, and some years in silver and salt, and leading the world in the production of mercury. A large amount of iron is also produced. Spain's coal-bearing beds are estimated to cover 3,500 square miles, but so little has the coal industry been developed that all manufacture goes on in the seaside cities by the use of imported coal. Water-power also is but little developed. The mines of Spain are chiefly worked by foreign capital. Over 70 per cent of the railways are owned by foreign companies. Ox teams and mule trains, along uncommonly bad roads, are still the only existing lines of communication in some of the mountainous regions.

Why Spain is So Unprogressive

Spain's industrial backwardness, despite its natural wealth, is due to the character of its surface and its people. The great barrier of the Pyrenees, passable only at either end, has prevented the country from becoming a cross-roads of commerce between Africa and the rest of Europe; while its many ranges of east-to-west interior mountains and its unnavigable streams have isolated its people into sharply differentiated groups, speaking different dialects and languages. It was not until the 16th century that political unification was accomplished, and even today the differences of customs, sentiment, and economic organization are so marked that Spain is a nation divided against itself, with bitter regional and political animosities. Other factors too have handicapped Spain—the rigors of the Inquisition, which stamped out individual initiative; the neglect of trade and industry in the quest of gold in the New World; unwise monetary policies; and the depopulation which resulted from centuries of warfare. Spain today is as thinly populated as Ireland; with twice the area of the British Isles, it has only half as many inhabitants. Spain's economic progress has also been greatly retarded by illiteracy. Until a few years ago two-thirds of the Spaniards were unable to read, although this proportion is being slowly reduced. Spain has nine universities—Madrid, the largest, Salamanca, the oldest, Granada, Seville, Valencia, Santiago, Saragossa, Valladolid, and Barcelona.

THE ANCIENT FORTRESS CITY OF AVILA



On the flat summit of a bleak hill, commanding a desert landscape of austere and rugged beauty, rise the ancient towered walls of Avila, birthplace of Santa Teresa and one of the most remarkable of Spanish inland fortress cities. The granite walls are 40 feet high, 13 thick, and about four miles around, though much of the city lies outside of them. It is said that 200 men could stand on each of the 86 towers.

The pageant of Spain's past is as picturesque and full of contrasts as the country itself. Ten centuries before our era the Phoenicians sought its shores in their tiny ships for iron and tin. Five hundred years later Carthage colonized the land and held it until Rome's galleys and armies drove out the Carthaginians in 201 B.C. Then came six centuries of Roman colonization and government, during which most of its cities were founded and Spain grew to nearly three times the population it supports today. Two Roman emperors, Trajan and Hadrian, were Spanish born, and Spain contributed practically all the greater authors of the "silver age" of Latin literature. The bull fight, Spain's most popular diversion today, is really a survival from the Roman wild beast shows of ancient days.

With the 5th century A.D. began 300 years of subjection to barbarian conquerors—the Vandals, who gave their name to Andalusia (Vandalusia), the Suebi, and the Visigoths. The Visigothic period (415–711) ends with the great battle of Jerez de la Frontera (711) in which Moorish invaders from Africa overthrew the Goths and established a Mohammedan power which lasted over seven centuries.

THE SPACIOUS HARBOR OF BARCELONA

The entrance to Barcelona harbor, protected by a large mole, is between two long piers; the building in the foreground is the customs warehouse. Barcelona is one of the chief Spanish seaports.

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The Moorish period represents a stage in the pageant of Spanish history almost richer than the time of the Romans, and the development that the Moors gave the land has persisted to our own day. They made the arid soil of Spain blossom like the rose, and the old Roman cities built over again on Arabic lines began to develop graceful palaces and vast mosques with domes and minarets. Fine metal work and silk and leatherwork as beautiful as any from the Orient came out of Spain, and a Toledo blade became as desirable as one from Damascus.

A SQUARE IN THE NEWER PART OF MADRID

This is the center of the financial district of Madrid. While in the old part of Madrid the streets are narrow, the greater part of the city is modern, with wide streets radiating, like the spokes of a wheel as here, from the public squares.

Christian kingdoms meantime were formed in the northern mountains and were nibbling bit by bit from the Moorish domains. The kingdom of Asturias on the Bay of Biscay, which later expanded into the kingdom of Leon and Castile, was the cradle of Spanish liberty. Soon Aragon, Navarre, and the county of Barcelona (Catalonia), at the foot of the Pyrenees, and Portugal on the Atlantic, arose to join in the age-long battle to free Spain from the infidel. In the battle of the plains of Tolosa (1212) the combined kingdom of Castile and Leon practically broke the Moorish power and shut it up in the small Mohammedan kingdom of Granada.

From this period come the great tales of chivalry. Among these are the songs and stories which tell of the valiant Christian knight "the Cid" (meaning "commander"—his real name was Rodrigo Diaz), who in the 11th century did so many deeds of prowess in behalf of his master the king of Castile.

With the marriage in 1469 of Ferdinand of Aragon and Isabella of Castile, most of Spain was united under a single rule. In 1492—the year Columbus gave the New World to the Spanish crown—came the final expulsion of the Moors from Spain through the conquest of Granada. In 1512 the Spanish part of Navarre was conquered. Thenceforth only Portugal and the tiny mountain republic of Andorra remained outside the rule of the king of Spain.

With the grandson of Ferdinand and Isabella, Charles I of Spain—better known as Emperor Charles V—Spain became mistress of most of the world. Charles V ruled Spain, Naples and Sicily, the duchy of Milan, and the Netherlands, and was the imperial lord of Germany as well as of the treasure countries of the New World. With his son Philip II, the Inquisition spread its baneful influence over Spain. Moors and Jews were expelled, and Protestants and even Catholic Spaniards themselves were tortured and burned at the stake in terrible bonfires known as the *autos da fe* or acts of faith. Freedom of thought and initiative were crushed at the same time that the resources of the kingdom were permanently impaired in the vain attempt to suppress Protestantism in other lands. (*See* Armada, Spanish.)

Thenceforth Spain sinks to the rank of a second or third-rate power. The War of the Spanish Succession (1701–14) cost it most of its outlying possessions in Europe and seated a French Bourbon prince on its throne. In the Peninsular War (1808–14) it was the British forces under the Duke of Wellington who freed the peninsula from Bonaparte rule. Misrule and revolt (1810–25) lost the Spanish colonies in the New World, except the small remnant (Cuba and Porto Rico) conquered by the United States in the Spanish-American War of 1898.

BULL FIGHTING, THE NATIONAL SPORT OF SPAIN

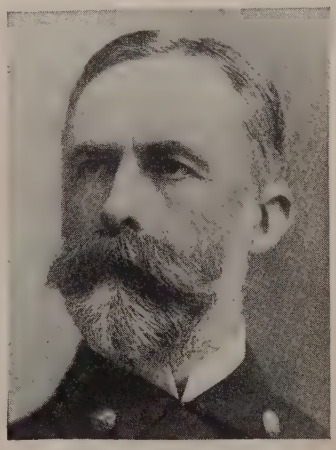
Bull fighting is to the Spaniard what baseball is to the American. Every fine Sunday afternoon in nearly every city of the land immense throngs assemble for their favorite amusement. Everyone knows the curious old formalities and rules according to which the contests are conducted, and is as familiar with the exploits and the special abilities of the famous matadors as any American is with those of the baseball stars of the day. The matador in the center of this picture is watching his opportunity to rush and deliver the final stroke with the sword which he holds concealed under his cloak.

THE VALLEY OF ARAN, HIGH IN THE PYRENEES

The Garonne River takes its rise in the valley of Aran, overhung by the Maladetta ("accursed") range, the highest peaks of the Spanish Pyrenees. Dangerous avalanches sometimes descend on the valley. But at this moment we see a peaceful summer scene, a road skirting the stream as it winds between the majestic mountains.

contained in the Easy Reference Fact-Index at the end of this work

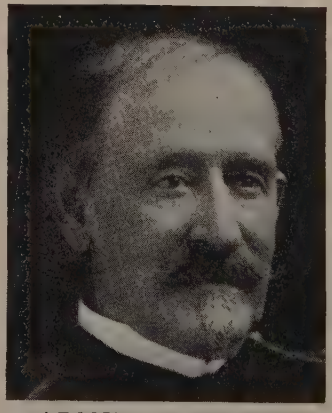
But as the old absolutist Spain decayed, a new and more liberal Spain was springing up. In 1812 the Cortes (legislative assembly) enacted a constitution whereby the king should no longer be absolute, and from that year a struggle between absolutism and limited monarchy was hotly waged. The political unrest culminated in a short-lived republic (1873–75). The present constitution, enacted in 1876, leaves little power to the king, the real government being in the hands of a responsible cabinet. The Cortes, corresponding to Congress in the United States, consists of two houses of equal authority, the senate and the congress of deputies. The latter body is elected but the senate is half elected and half composed of grandees and "senators in their own right," and of life senators appointed by the government. Neither senators nor deputies receive salaries.



ADMIRAL SAMPSON

SPANISH-AMERICAN WAR (1898). Few wars in history have been of such short duration and yet have had such far-reaching results as that between Spain and the United States in 1898. Hostilities lasted only 114 days, but at the end of that time the United States had acquired Porto Rico, Guam, and the Philippines, and had freed Cuba from Spanish rule.

This brief but important conflict was due primarily to Spain's misgovernment of Cuba. In that island taxation was outrageously high; trade was shackled in Spanish interests; and the natives were despised and insulted by Spanish officials. In 1895 the island had revolted, and the war which followed was marked by extreme cruelty on both sides and by great loss of lives and property. The leader of the rebels ordered the destruction of plantations, burned sugar factories, and laid waste thousands of acres of valuable lands, much of it owned by Americans. What he left undone was finished by the Spanish general, Weyler, who not only destroyed property but rounded up the rural inhabitants in military camps where they died by hundreds of starvation and disease. The "Gem of the Antilles" was rapidly becoming a desert and a graveyard.



ADMIRAL SCHLEY

The cruelties of the Spanish generals stirred the sympathies of the American people, and these sympathies were played upon by American capitalists who had large interests in the sugar industry in the island. President McKinley was able to control the situation for some months, while he tried to secure satisfactory concessions to Cuba from Spain. The negotiations were still in progress when a new trouble arose. On Feb. 15, 1898, the American battleship *Maine*, which had been sent by President McKinley to protect Americans in Havana, was blown up in the harbor with the loss of 260 of her men. Although Spain denied any responsibility for the explosion—and the charge has never been proved—many Americans believed that it was due to a mine exploded by Spanish officials. The cry "Remember the Maine" reinforced the previous demands for American intervention for the ending of Spanish rule in the West Indies.

On April 19, Congress recognized Cuba as free and gave the president power to use the army and navy to expel the Spaniards. The coasts of Cuba were immediately blockaded by Rear-Admiral William T. Sampson with the Atlantic fleet, which was reinforced by the battleship *Oregon* after it had made a spectacular trip from the Pacific coast around Cape Horn. The necessity for this long voyage directed the attention of the American people to the naval need for a canal across the Isthmus of Panama.

The Spanish admiral Cervera, with a fleet from Spain, was able to slip into the harbor of Santiago on May 19, but he was at once "bottled up" by American ships. Lieut. R. P. Hobson became a popular hero by his attempt to close the harbor by sinking the collier *Merrimac* in the channel. With the Spanish navy shut up, troops were brought over to Cuba from Florida, and a land campaign was begun. Gen. Joseph Wheeler, a former Confederate general in the Civil War, now showed the reunion of the North and South by serving as a major-general of volunteers. The most serious battles occurred at El Caney and San Juan Hill, near Santiago. In the latter battle (July 1), the famous "Rough Riders" under Lieut.-Col. Theodore Roosevelt distinguished themselves, after they had marched all night to be in the fight.

The victory of San Juan made it impossible for the Spaniards to hold the harbor of Santiago, and fearing capture by a land army their fleet attempted to escape on the morning of July 3. Within a few hours after they put to sea all the Spanish ships were sunk or driven on the shore by Commodore Winfield S. Schley, who in the absence of Admiral Sampson commanded the American fleet. Subsequently there was much controversy between the partisans of these two officers as to the credit due each. This naval victory marked the doom of Santiago, although the city did not formally surrender until July 17.

The fall of Santiago ended the war in Cuba. Other troops were rapidly conquering the neighboring Spanish island of Porto Rico, when news arrived of negotiations for peace.

LIEUTENANT HOBSON

The war was also waged in the Eastern Hemisphere, for when war was declared Commodore George Dewey, in command of a small squadron, sailed from China for the Philippines, then a Spanish possession. On May 1 he entered Manila Bay over mine-strewn waters. He destroyed or captured the Spanish fleet under the guns of the land fortress, and began the siege of the city, a siege which was not finished until August 13, the day after the surrender of the Spaniards in Cuba.

The final treaty of peace, concluded at Paris in October, provided that Cuba should be free, and that Porto Rico, the Philippines, and Guam should be given to the United States in return for a payment of $20,000,000.

Spanish language and Literature. Spanish, like French and Italian, is a Romance language; that is, it is an outgrowth of Latin, the language of Rome (*see* Romance Languages). It does not sound a great deal like Latin when we hear it spoken today. But if we know some Latin it makes Spanish much easier to learn because the roots of many of the words are the same.

Many persons are studying Spanish now in the United States. One reason is that this is the language spoken throughout the greater part of South America and many boys and girls are studying it in school so that they may later use it in business correspondence. Others are studying Spanish so as to be able to read Spanish literature. For though the literature of Spain is not so well known as that of some other countries, it is one of the most distinctive and one of the most interesting in the world. The beautiful Castilian dialect, which is the standard literary tongue, is at the same time soft and musical and clear and vigorous. Many elements have entered into it, but it still retains its originality, its naturalness, its flavor of the soil. And these are the qualities, too, which distinguish Spanish literature. Not so subtle or profound as English or French, for example, it is unsurpassed in its vividness, its forcible realism, its directness of vision, and its keen humor and satire.

CERVANTES

The earliest example of Spanish literature in existence today is the famous 'Poem of the Cid', which was composed probably in the latter half of the 12th century. It is a song of the warlike deeds—romantic and spirited—of the Christian champion called "the Cid" (commander) against the infidel Moors. In the 12th century, too, were composed miracle plays for religious instruction. One of these, 'El Misterio de los reyes magos' (Mystery of the Magian Kings), tells of the three kings, or wise men, who followed the star to Bethlehem to visit the infant Jesus.

In the 15th century romances of chivalry, with characters like the knights of King Arthur's Round Table, appeared. The most famous of these medieval romances was that of the 'Amadis de Gaula'. Ballads were composed, also, passing from father to son and not written down at the time, and later on these were collected. The most interesting of them celebrate national heroes and the Moorish champions against whom they fought.

The 16th and 17th centuries are called the Golden Age of Spanish literature. Spanish writers stopped imitating French and Italian writers and began to develop a style of their own. At this time Lope de Vega (1562–1635) wrote about 2,000 dramas, including comedies, tragedies, and historical plays. He is called "the father of the Spanish theater." Another dramatist of note was Calderón (1600–1681), whose plays are full of beautiful poetry. 'La Vida es sueño' (Life is a Dream) is one of the most famous. The best known and the best loved of Spanish books, 'Don Quixote', was written at this time by Cervantes. It pokes fun at the declining romance of chivalry so successfully as to kill it with ridicule. The work is full of quaint humor and deep insight into human nature, and is well worth reading, even if only in some good translation (*see* Cervantes).

Spanish power declined at the close of the 17th century, and with it Spanish literature. Writers began to imitate French models, instead of seeking national individuality. Moratin, who lived from 1760 to 1828, is often called the Spanish Moliére, because his work resembles so closely that French writer's.

IBAÑEZ

The dramas of the early 19th century were chiefly romantic; many were later turned into operas. The Italian opera 'Il Trovatore', for instance, is taken from the drama 'El Trovador', by Gutiérrez. Other dramatists of note are José Echegaray, Jacinto Benavente, and the Quintero brothers. After 1850 plays dealt rather with current social and psychological problems.

Since 1850 the novel has been perhaps the most important type of literature written in Spain. Fernán Caballero was among the first to win distinction as a novelist. Other names well known in Spain today are Pedro Antonio de Alarcón, whose 'El Sombrero de tres picos' (The Three-cornered Hat) is widely read in America in translation; Pereda, who has written of country folk, of sailors, and of the poor; Pérez Galdós, whose chief works are political and historical novels; Juan Valera, Valdés, Emilia Pardo Bazán, and (best known of all) Vicente Blasco Ibañez. Blasco Ibañez' novel 'Los Cuatro jinetes del apocalipsis' (The Four Horsemen of the Apocalypse) is perhaps the most famous and most widely read novel dealing with the spirit of the World War. (*See* Ibañez, Vicente Blasco.)

SPARROW. There are 40 kinds of useful and interesting sparrows, and only *one* with a bad reputation. Yet it is this one, the English or house sparrow, that everybody knows, and by most people the sparrow family is judged accordingly. But for all his bad habits and untidy ways, this hardy little fellow has two good points: he has saved alfalfa crops from destructive insects; and, good or bad weather, hungry or satisfied, he never mopes. Some maintain that, in general, he does as much good as harm.

Sparrows are small, plain-colored birds, belonging to the finch family. They are found in almost all parts of the world. Most species are singers of considerable merit. Most are migratory, some are permanent residents. Some nesting in the far north spend the winter in the United States. The nesting habits vary, some building in trees and bushes, others on the ground. All are prolific, and all are seed-eating birds, feeding largely from weed growths, hence they are of great value to farmers.

The following estimate of the amount of weed seed eaten is taken from a leaflet published by the National Association of Audubon Societies: "To be well within safe limits, an average of ten birds (tree sparrows) to the square mile was allowed. Observation indicated that each sparrow would eat not less than one-fourth of an ounce of seed daily, and that the birds spent an average of about 200 days in the state, from their arrival in October till their departure in April. Putting these data together, it appears that this one kind of bird must be credited with the yearly destruction, in Iowa alone, of 1,750,000 pounds or 875 tons of weed-seed. If this were loaded upon freight cars, at the rate of 12 tons to a car, it would make a train of 72 cars and leave a little over."

Of the species found in the United States the song sparrows, white-crowned, vesper, lark, and white-throated sparrows are especially noted singers. The chipping sparrow is one of the most sociable of birds and is commonly found about dooryards. The grasshopper sparrow, $4\frac{1}{2}$ inches long, is the smallest of the American sparrows, but an even smaller species, called by the name, is found in Jamaica and Porto Rico. They are so named because of their buzzing insect-like song. Scientific name of house sparrow, *Passer domesticus*; of song sparrow, *Melospiza melodia*. (For illustrations in colors, *see* Birds.)

THE TREE SPARROW

The Tree Sparrow is one of the two native sparrows which winter in the United States, and one of the few native birds which sing real songs in winter. Notwithstanding its name, it is most frequently found on the ground and seldom even nests in trees.

SPARTA, GREECE. The great rival of Athens in ancient Greece was Sparta, whose vigorous race of iron-hearted warriors has given us the adjective "spartan." More like a group of straggling villages than a city, Sparta prided itself not on art or learning or splendid buildings, but on its valiant men who "served their city in the place of walls of bricks." And although Athens, with her beautiful temples and statues, her poetry and philosophy, dominated the intellectual life of the world, it was Sparta which in the end snatched from her cultured opponent the political supremacy over the Greek states.

The Spartan government was founded on the principle that the life of every individual from the moment of birth belonged absolutely to the state. The elders of the city inspected the newborn infants and ordered the weak and unhealthy to be carried to a nearby chasm and left to die. By this inhuman practice Sparta made sure that only those who were physically fit should survive.

The children who were allowed to live were brought up under an iron rule. At the age of seven the boys were removed from the control of their parents and organized into small bands over which the strongest and most courageous were made captains. They slept in public dormitories upon hard beds of rushes; they ate together of black broth and other coarse and meager fare; and they wore only the simplest and scantiest clothing. They were drilled each day in gymnastic and military exercises until their muscles were like iron and their will-power like steel. They were taught to endure

WHERE SPARTA MADE HER YOUNG CITIZENS STRONG AND HARDY

Here are some Spartan youths receiving a most important part of their education. The temples and statues of the gods, and especially of the Great Twin Brethren Castor and Pollux—Spartans and athletes as well as gods—looked over it, for nothing, according to Spartan view, was more worthy of divine approval than the training of brave and hardy citizens.

pain and hardship without complaint, and to obey orders absolutely and without question.

They were allowed to feel the pinch of hunger and encouraged to supplement their fare by pilfering food for themselves. This was not done to cultivate dishonesty, but to develop shrewdness and enterprise. If they were caught, they were whipped for their awkwardness. Once, it is said, a Spartan boy, having stolen a young fox for his dinner, allowed the animal, which was hidden under his cloak, to gnaw out his vitals rather than to betray his theft by crying out. The girls were educated in classes under a similar system, but with less rigor.

Discipline grew even more rigorous when the boys reached manhood. All Spartan citizens between the ages of 20 and 60 served in the army, and though allowed to marry, all had to belong to a men's dining club and eat and sleep in the public barracks. They were forbidden to possess gold and silver and their money consisted only of iron bars. War-songs were their only music, and their literary education was slight. No luxury was allowed even in the use of words. They spoke shortly and to the point, in the manner which we have come to call "laconic," from Laconia, the district of which Sparta was the capital (also called Lacedaemon).

The Three Classes in Sparta

There were three classes of inhabitants in Laconia. The Spartan citizens (*Spartiates*), who lived in the city itself and who alone had a voice in the government, devoted their entire time to military training. The *Perioeci*, or "dwellers-round," who lived in the surrounding villages, were free, but had no political rights. They were the tradesmen and mechanics—occupations not allowed to the Spartans. The *Helots* were serfs, little better than slaves, bound to the farms and forced to cultivate the soil for the citizens, their masters, who owned the land. These Helots whose marriages and children were not so strictly controlled by the state, were the most numerous class and bitterly hated their masters. Only the amazing organization and splendid fighting powers of the Spartan state could keep them under control.

Two Kings to Check Each Other

Another strange feature of Sparta was that the government was headed by two kings, who ruled jointly, serving as high priests, as well as leaders in war. Each king acted as a check on the other. There was a sort of cabinet composed of five *ephors* or overseers, who exercised a general guardianship over law and custom and came in later times to have greater power than the kings. The legislative power was vested in the assembly of Spartan citizens and in a senate or council of elders, chosen from the men who had passed the age of 60.

The Spartan armies, although usually quite small, were all but irresistible. Each citizen soldier was inspired by the resolve to win or die. The Spartan mother, when she gave her son his shield, used to say: "Bring back this shield yourself or be brought back upon it," referring to the manner in which the dead were carried from the battlefield.

The Spartan constitution is said to have been founded by Lycurgus (*see* Lycurgus). Under the

rigid discipline of its laws, Sparta extended its conquests over the neighboring states until it gained control of most of the Peloponnesus—the peninsula forming the southern half of Greece.

Sparta's prowess naturally brought rivalry with Athens, the leader of the northern states and for a time of all Greece. This rivalry culminated in the Peloponnesian War (431–404 B.C.) which resulted in Athens' ruin and Sparta's supremacy. But the tyranny of the Spartans aroused hatred and rebellion, and the jealous limitations on citizenship gradually cut down the number of the specially trained warriors until only a few hundred remained. After about 30 years of Spartan domination, the Thebans under Epaminondas defeated Sparta and ended her power. With the rest of Greece, Sparta was soon conquered by the Macedonians, and finally became a part of the Roman Empire. (*See* Greece.)

The modern town of Sparta, built after the Greek War of Independence in 1834, occupies part of the ancient site, near the river Iri (the ancient Eurotas) and about 15 miles from the Gulf of Messenia. Present population, about 4,500.

SPARTACUS (died 71 B.C.). For many years the name of the Thracian slave Spartacus was terrible to the ears of the old Romans; for it reminded them of the danger that constantly menaced the very existence of their state, the danger of an uprising of the enormous slave population that might wipe out the Roman nation at a blow. Scholars have calculated that for every freeman in ancient Italy there were three slaves. If these unhappy men, goaded by the brutal treatment they received as household and plantation laborers, had once united under capable leadership, nothing could have withstood them.

There were many slave uprisings in the history of Rome, but the most formidable was that headed by Spartacus in 73 B.C. Escaping from the school of gladiators at Capua, he fled to Mount Vesuvius, where he collected an army of runaway slaves like himself. For two years he terrorized Italy, defeating army after army sent against him from Rome, and laying the land waste from the foot of the Alps to the southern tip of the peninsula. But the insurrection was finally crushed, Spartacus was slain, and 6,000 of his followers were crucified along the Appian Way leading to Rome.

Probably the children of today are not so familiar with Elijah Kellogg's imaginary address, 'Spartacus to the Gladiators at Capua', as were their fathers, many of whom have stood on the schoolroom platform on Friday afternoons and recited stirring lines concluding: "If ye are men—follow me! . . . if we must fight, let us fight for ourselves! If we must slaughter, let us slaughter our oppressors! If we must die, let it be under the clear sky, by the bright waters, in noble, honorable battle!"

At the close of the World War of 1914–18, the name "Spartacans" was applied to the extreme radical wing of the German Socialists, from the fact that its leader, Karl Liebknecht, had written under the pen name of "Spartacus" while held prisoner by the German government. The origin of the group is found in the opposition of the extreme left to the war, which led to a split in the Socialist party and the formation of the Independent party—Spartacans. After the revolution of 1918 and the overthrow of the Kaiser, the party became even more radical.

SPECTACLES. Few persons have perfect vision. The eye is so delicate an instrument that the slightest irregularity in its structure produces serious defects of vision (*see* Eye). Many of these errors may be corrected by wearing spectacles, which are lenses so ground as to counteract the fault in structure.

To find out just what lenses your eyes require, the oculist (eye specialist) makes various tests. He asks you to read lines of letters of various sizes from a chart and to describe various pictures and combinations of lines that he shows you; he examines the retina itself by the aid of a strong light and a magnifying glass. Thus he finds out not only how far your vision differs from the normal but also the cause of the trouble. In some cases the muscles which converge the eyes are weak; the eyes themselves may be nearsighted; they may be far-sighted (all eyes become farther sighted with advancing years); they may be so shaped as to give distorted images; very frequently the two eyes differ. It is comparatively easy to find out how far the vision is from "20/20" or normal, but much skill and experience are required to determine the exact nature of the defect. That is why it is well worth the fee to have the eyes properly tested by a specialist. Glasses bought of an itinerant peddler or made after inadequate examination may ruin the sight.

The oculist writes a prescription for a lens for each eye. The optician grinds, from plain lenses of specially prepared optical glass, lenses with the prescribed curves. Concave lenses are used to correct short sight, convex lenses for far sight; prisms, where the eyes turn in or out too much; segments of cylinders, for astigmatism or irregular curvature of the cornea; and endless combinations and modifications of these forms for complicated conditions.

Then the optician fits the ground and polished lenses into frames, adjusting each lens so that its center will come at exactly the right point in front of the pupil, and tilting it to give just the right angle for reading or distant vision. Glasses with side bars or bows to pass over the ears are specifically designated "spectacles," while those which clip to the nose are called "eye-glasses" or "pince-nez." Single eye-glasses or "monocles" and glasses mounted on a handle ("lorgnettes") are also used. Plain colored glasses are used to protect from glare and dust.

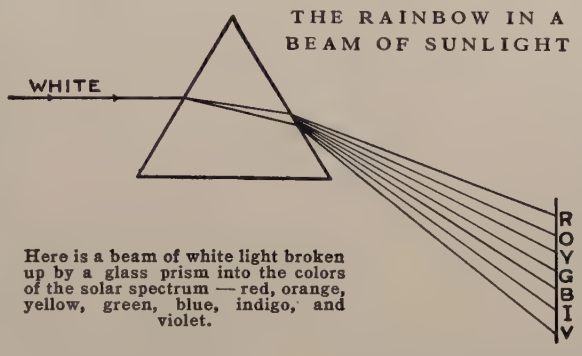
Spectacles were invented late in the 13th century, perhaps by Roger Bacon (*see* Bacon). They were crude and clumsy at first, and little improved for centuries. Bifocal lenses were invented by Benjamin Franklin; these have a small lens for reading and near vision set into a larger lens for distant vision. The old-style lens gave perfect vision only at the center but the modern "toric" lens gives the same correction to the sight clear to the edge.

WHAT *the* RAINBOW TELLS *the* SCIENTIST

How Its Little Brothers Reveal the Nature of Color and What the Sun and Stars are Made of—The Spectroscope with which We Read the Message and Learn These Distant Secrets

SPECTRUM AND SPECTROSCOPE. No doubt you have at times seen little rainbows projected from the beveled edge of a hand mirror, or from a prism. Did you guess that you held in your hand the key to one of the most wonderful secrets of Nature?

The Greeks, you remember called the rainbow goddess Iris, "the messenger of the gods," yet they never read her message. By deciphering the message of the little rainbow made by a prism of glass, Sir Isaac Newton and others who came after him were able to learn not only what the great rainbow in the sky really is, but the nature of color and the composition of the sun and the stars. You can scarcely guess what strange messages Iris brings from the far borders of space. "On the moon," she says, "there is neither water nor air; on the sun there are sodium, iron, gold, and other familiar elements." Most wonderful of all, she can ofttimes tell us whether a star is moving toward the earth or away from it.



Here is a beam of white light broken up by a glass prism into the colors of the solar spectrum — red, orange, yellow, green, blue, indigo, and violet.

Men have rejoiced to see the rainbow since the very beginning of history, but it was not until 1672, that it was possible to explain the colors of the rainbow. In that year, Sir Isaac Newton described his experiments in passing sunlight through a glass prism, which showed that a beam of white sunlight is a bundle of different colored rays—of red, orange, yellow, green, blue, indigo, and violet light (*see* Light; Rainbow).

Newton's experiments can be repeated with a couple of simple glass prisms. Let a beam of sunlight, such as comes through a small opening in a shade or shutter, pass through a glass prism. On the opposite wall appears the beautiful band of colors, the spectrum. The beam of white sunlight has been bent, or *refracted* by the glass prism, but the violet light has been refracted most, and the red light refracted least. Newton then showed by using a second prism that the beam of colored light could not be broken up again into colors. Since these experiments of Newton, we have known that white sunlight is a combination of colored lights, and that the rainbow is sunlight which has been broken up into spectral colors by the water drops in the sky, the drops acting like prisms.

But we know that different colors mean different wave lengths of light, and that a beam of sunlight contains as many wave-lengths of light as there are shades of color in the spectrum. But now look at a spectrum and see how the colors shade gradually and continuously into one another, and notice that there is a countless number of shades. By means of a beautiful device called a diffraction grating, Professor Rowland made a very long spectrum of the sunlight. This he photographed and got a spectrum band more than 20 feet long, so that he could measure thousands of wave-lengths in the sunlight. And these wave-lengths tell us a most interesting story about the kinds of matter in the sun.

When a body is heated very hot, so hot that it turns to vapor or gas, its atoms vibrate rapidly enough to give off light. Each kind of atom vibrates in its own peculiar way, and each different kind of vibration gives a characteristic assortment of colors in the light it causes. You know that you can tell a person by his voice, for no two persons have exactly the same tones and inflections when they speak. In a similar way, no two kinds of atoms in the gaseous or free vapor state have exactly the same kind of vibrations, nor do they send out exactly the same wave-lengths of light. Throw into the hot fire a little common table salt, and notice the bright yellow light that comes off. That special yellow light is due to the vibrating sodium atoms of the vaporized salt, and a corresponding line of yellow light always appears at a certain place in the spectral band when it is present. No other kind of hot gaseous atom gives off those peculiar wave-lengths of yellow light nor causes these particular lines to appear. Hence, when we examine the spectrum of the sun or of a star and find that particular band or line of yellow light, we know that the sun or the star contains sodium.

In order to carry on this work thoroughly, scientists have obtained the spectrums which correspond to the different elements, have checked up every line that each element gives off, and charted them. When they want to study the light from a star, they photograph its spectrum, and then check the lines against the charts for the elements. When in the star spectrum they find all the lines corresponding to a certain element, they know that the element is present in the star, as we saw in the case of sodium; and when every line in the star spectrum is accounted

for, the analysis is complete. In this way, we have found by the light sent off from the sun and other stars that they are made of many of the common substances on the earth, such as iron, carbon, calcium, and hydrogen. Thus we know the composition of the distant stars just as truly as if we could have pieces of them to examine in the laboratory.

This process goes a long way in itself toward making possible the analysis of incandescent bodies, such as the sun and stars. The spectrum has another property, however, which makes the process completely workable, the phenomenon of "absorption."

When the light from an incandescent solid or liquid is thrown directly through a prism to produce a spectrum, it causes the bright lines characteristic of its elements to appear in a continuous spectrum. This is called an "emission" or "bright line" spectrum. If, however, the light, on the way to the prism, passes through a gas at a lower temperature, the gas "absorbs" the lines characteristic of it, and corresponding dark lines appear in the spectrum. This is called a "dark line" or "absorption" spectrum, and the dark lines are known as "Fraunhofer lines," after the Bavarian optician who discovered them in the spectrum of sunlight. Their appearance in the spectrum of sunlight is explained by saying that an outer wrapper of gases about the sun absorbs the bright lines produced by the gases at the center of the sun. By studying these Fraunhofer lines and producing them by inserting known "absorbers" in the path of light, scientists make the spectroscope tell far more than it otherwise would.

How the Spectroscope Found Helium

A beautiful example of what spectroscopy, or the study of spectrums, can do is afforded by the case of helium. The position of most of the dark lines in the solar spectrum coincides with the positions of lines for substances known on earth. In 1868, however, lines which could not be so identified were found in the solar spectrum. This was taken to mean that an element unknown to us existed on the sun. This element was called "helium" after *helios*, the Greek word for "sun." Then in 1895, while investigating the marvelous substance radium, scientists found that it gave off minute quantities of a light gas, and identified the new substance with the helium of the sun by means of its spectrum.

Another marvelous fact is that the lines in the spectrum of a star shift toward the violet side, if the star is moving toward the earth and toward the red side if the star is moving away. This is due to the crowding together of the vibrations, giving vibrations that apparently are of shorter wave-length in the one case, and a wider spacing in the other. A similar thing happens when the whistle of a locomotive rises to a shrill sharp screech as it comes toward you, and then drops in pitch as it recedes in the distance. The sound waves are crowded together and the tone is raised while the motion is toward you, and the waves are dragged apart and the tone lowered as the motion is away from you. In the case of light, instead of different tones we get color changes.

The little rainbow we have been talking about is known as the "visible spectrum." But since all the colors are caused by vibrations or "ether waves" of varying length, it is natural to expect that an "invisible spectrum" exists—a spectrum containing waves shorter than the shortest light wave, and other waves longer than the longest light wave. And so it does, with a tremendous range of wave lengths.

At one end of the scale are the long Hertzian waves, some of them several miles from crest to crest, and vibrating at the rate of tens of thousands in a second. These Hertzian waves are used in wireless telegraphy, and grade down in length to the shortest, which are only a few feet from crest to crest. Shorter than Hertzian waves, but still much longer than the waves which produce light, are the waves of radiant heat, which may be detected by sensitive heat-measuring instruments. These waves grade down in length until they approach the length of the longest light wave, which is red, and lie in the so-called "infra-red" region of the spectrum.

The Tiny Waves We See

The visible rays come next, shading from the extreme red, which is longest, to the extreme violet. Of the longest waves, the extreme red, there are about 400,000,000,000,000 vibrations in a second; it would take about 34,000 of them, placed end to end, to cover one inch. Of the shortest light rays, the violet, there are more than 780,000,000,000,000 in a second, and more than 64,000 of them would be required to span an inch.

Still shorter than the shortest visible waves are the so-called "ultra-violet rays," which are so injurious to eyesight and so destructive to bacteria. And beyond them on the scale are the X-rays (*see* X-Rays) which are so short that they cannot be refracted, and which therefore for a long time could not be proved to be vibrations at all. And all these rays, so various in their perceptible effects, some giving us light and others heat, some assailing our bodily tissues and others passing over our head, without effect unless snared in strange artificial devices like those which enable us to capture the Hertzian waves—all these you must understand to be ether vibrations (*see* Ether) essentially alike except in wave-length, which varies from the length of an army front to an unimaginable minuteness.

The spectrum, you see, is like a gigantic piano keyboard. Near the middle, one octave represents the range of visible light rays. Some of the octaves on either side have been played on, others have not; that is, we know something of the effect of some of the rays which they represent, and nothing or practically nothing of some of the others. We are like children standing on tiptoe to pick out a tune here and there on the parts of the keyboard that we know.

In order to study spectrums, ingenious instruments called spectroscopes have been devised. The

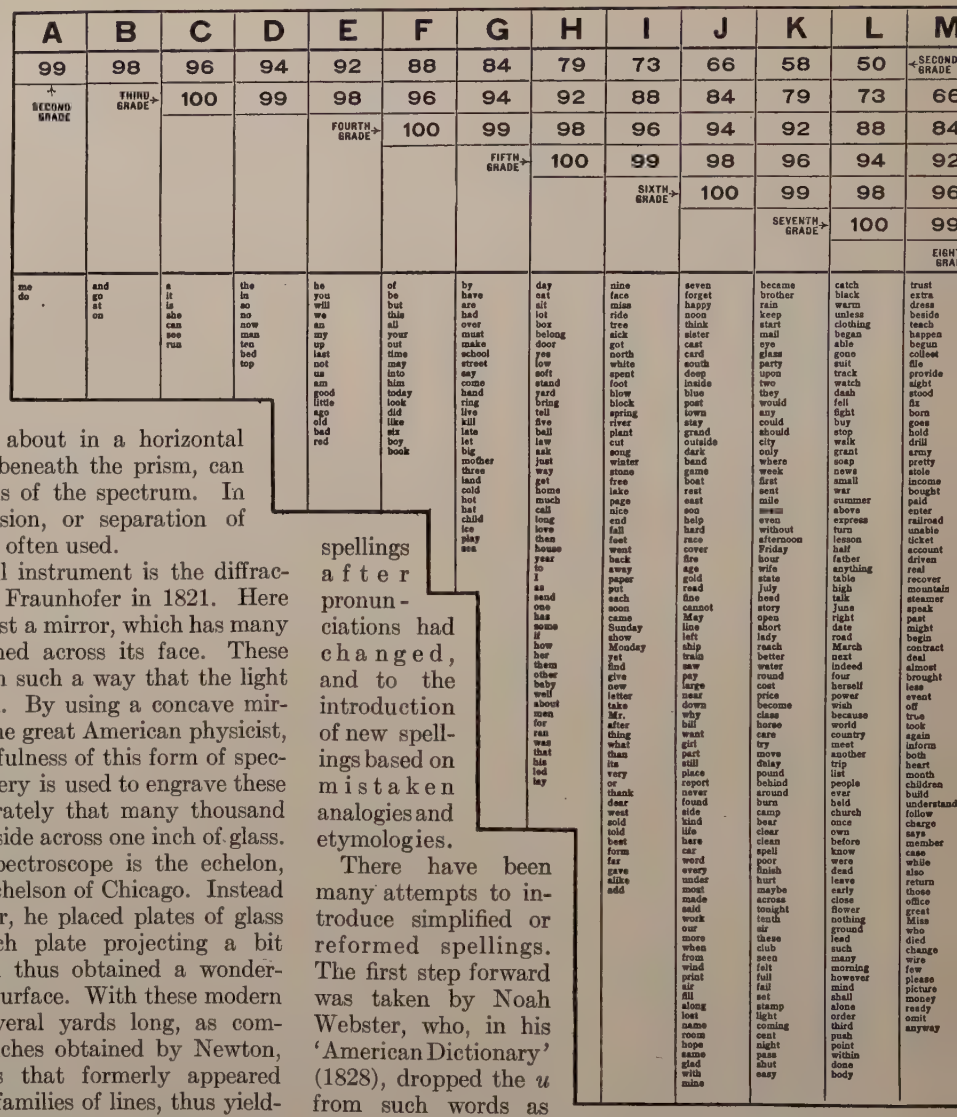
The rays of light from any incandescent element, if passed through a spectroscope, will produce in the spectrum a set of dark lines peculiar to that element. This enables scientists to determine the elements which make up the most distant stars. Here, for instance, the spectrum from Aldebaran shows that this star contains hydrogen, calcium, barium, etc. At the right the spectrum given by sunlight and that given by heated sodium are compared, showing how the sodium lines are always found in the same place and so can readily be recognized.

contained in the Easy Reference Fact-Index at the end of this work

oldest is the prism spectroscope, which uses the method developed by Newton. The light to be studied is admitted through a slit in one end of a horizontal tube called the collimator, and projected by a lens at the other end upon one face of an upright prism. When it leaves the prism, broken up into a spectrum, it falls upon one end of a small telescope. The observer sits at the other end, and by moving the telescope about in a horizontal arc, which has its center beneath the prism, can examine different portions of the spectrum. In order to increase dispersion, or separation of colors, a train of prisms is often used.

A more generally useful instrument is the diffraction grating invented by Fraunhofer in 1821. Here the light is reflected against a mirror, which has many parallel fine lines scratched across its face. These lines break up the light in such a way that the light is reflected as a spectrum. By using a concave mirror, Professor Rowland, the great American physicist, in 1882 increased the usefulness of this form of spectroscope. Special machinery is used to engrave these lines, and works so accurately that many thousand lines can be ruled side by side across one inch of glass.

The newest form of spectroscope is the echelon, invented by Professor Michelson of Chicago. Instead of ruling lines on a mirror, he placed plates of glass one behind another, each plate projecting a bit beyond its neighbor, and thus obtained a wonderfully accurate diffracting surface. With these modern instruments spectrums several yards long, as compared with the several inches obtained by Newton, can be produced. Lines that formerly appeared single are broken up into families of lines, thus yielding an immense amount of detailed knowledge that could never have been obtained with the first crude instruments.


A YARDSTICK FOR MEASURING YOUR
A B C D E F G H I J K L M
99 98 96 94 92 88 84 79 73 66 58 50
SECOND GRADE
THIRD GRADE
100 99 98 96 94 92 88
FOURTH GRADE
100 99 98 96 94
FIFTH GRADE
100 99 98
SIXTH GRADE
100 99
SEVENTH GRADE
100
me do
and go at on
a it is she can see run
the in so no now man ten bed top
he you will we an my up last not us am good little ago old bad red
of be but this all your out time may into him today look did like six boy book
by have are had over must make school street say come hand ring live kill late let big mother three land cold hot hat child ice play sea
day cat sit lot box belong door yes low soft stand yard bring tell five ball law ask just way get home much call long love then house year to I as send one has some if how her them other baby well about men for ran was that his led lay
nine face miss ride tree sick got north white spent foot blow block spring river plant cut song winter stone free lake page nice end fall feet went back away paper put each soon came Sunday show Monday yet find give new letter take Mr. after thing what than its very or thank dear west sold told best form fer gave alike add
seven forget happy noon think sister cast card south deep inside blue post town stay grand outside dark band game boat rest east sea help hard race cover fire age gold read fine cannot May line left ship train saw pay large near down why bill want girl part still place report never found side kind life have car word every under most made said work our more when from wind print air fill along lost name room hope same glad with mine
became brother rain keep start mail eye glass party upon two they would any could should city only where week first sent mile ⁂ even without afternoon Friday hour wife state July heed story open short lady reach better water round cost price become class horse care try move ⅋ay pound behind around burn camp bear clear clean spell poor finish hurt maybe across tonight tenth sir these club seen felt full fail set stamp light coming cent night pass shut easy
catch black warm unless clothing began able gone suit track watch dash fell fight buy stop walk grant soap news small war summer above express turn lesson half father anything table high talk June right date road March next indeed four herself power wish because world country meet another trip list people ever held church once own before know were dead leave early close flower nothing ground lead such many morning however mind shall alone order third push point within done body
trust extra dress beside teach happen begun collect file provide sight stood fix born goes hold drill easy pretty stole income bought paid enter railroad unable ticket account driven real recover mountain steamer speak past might begin contract deal almost brought less event off true took again inform both heart month children build understand follow charge says member case while also return those office great Miss who died change wire few please picture money ready omit anyway

SPELLING. The spelling of the English language is the despair of foreigners and children. There are only 44 sounds in the language (24 consonants and 20 vowels and dipthongs), but they are written in about 500 different ways. No other language presents difficulties of spelling at all comparable to those of English. In other languages, when you have learned the letters and their sounds, and mastered a few general principles, you can spell almost any word you hear, and pronounce any word you see. The chaos which prevails in English spelling is due in part to the confusion in the formative days of the language between the phonetic standards of Anglo-Saxon and Norman French; and in part to the retention of old spellings after pronunciations had changed, and to the introduction of new spellings based on mistaken analogies and etymologies.

There have been many attempts to introduce simplified or reformed spellings. The first step forward was taken by Noah Webster, who, in his 'American Dictionary' (1828), dropped the *u* from such words as *favour, honour, mould, colour*, and changed the French-derived *metre, centre, theatre*, etc., to *meter, center, theater*. These simpler spellings have largely taken the place of the others in America, but the English still cling to the old forms. Of the many reform movements which sprang up later, the most effective was that represented by the Simplified Spelling Board, established in 1906. The 300 simplified spellings which it recommended are now used by hundreds of newspapers and periodicals. Twelve of their recommendations have been adopted by the National Education Association and are recognized by most of the new dictionaries; these are—*program, catalog, decalog, prolog, pedagog, tho, altho, thoro, thoroly, thorofare, thru, and thruout*. It is also generally considered correct to reduce the diphthongs *æ* and *œ* to *e* in such words as *anæmia* and *mediæval*.

For any subject not found in its alphabetical place see information

ABILITY IN SPELLING—THE AYRES SCALE

N	O	P	Q	R	S	T	U	V	W	X	Y	Z
58	50	←THIRD GRADE										
79	73	66	58	50	←FOURTH GRADE							
88	84	79	73	66	58	50	←FIFTH GRADE					
94	92	88	84	79	73	66	58	50	←SIXTH GRADE			
98	96	94	92	88	84	79	73	66	58	50	←SEVENTH GRADE	EIGHTH GRADE +
100	99	98	96	94	92	88	84	79	73	66	58	50
except	eight	spend	sometimes	forenoon	often	guess	meant	principal	organization	immediate	decision	judgment
aunt	afraid	enjoy	declare	lose	stopped	circular	earliest	testimony	emergency	convenient	principle	recommend
capture	uncle	awful	engage	combination	motion	argument	whether	discussion	appreciate	receipt		allege
wrote	rather	usual	final	avenue	theater	volume	distinguish	arrangement	sincerely	preliminary		
else	comfort	complaint	terrible	neighbor	improvement	organize	consideration	reference	athletic	disappoint		
bridge	elect	auto	surprise	weigh	century	summon	colonies	evidence	extreme	especially		
offer	aboard	vacation	period	wear	total	official	assure	experience	practical	annual		
suffer	jail	beautiful	addition	entertain	mention	victim	relief	session	proceed	committee		
built	shed	flight	employ	salary	arrive	estimate	occupy	secretary	cordially			
center	retire	travel	property	visitor	supply	accident	probably	association	character			
front	refuse	rapid	select	publication	assist	invitation	foreign	career	separate			
rule	district	repair	connection	machine	difference	accept	expense	height	February			
carry	restrain	trouble	firm	toward	examination	impossible	responsible					
chain	royal	entrance	region	success	particular	concern	beginning					
death	objection	importance	convict	drown	affair	associate	application					
learn	pleasure	carried	private	adopt	course	automobile	difficulty					
wonder	navy	loss	command	secure	neither	various	scene					
tire	fourth	fortune	debate	honor	local	decide	finally					
pair	population	empire	crowd	promise	marriage	subtle	develop					
check	proper	mayor	factory	wreck	further	political	circumstance					
prove	judge	wait	publish	prepare	serious	national	issue					
heard	weather	beg	represent	vessel	doubt	recent	material					
inspect	worth	degree	term	busy	condition	business	suggest					
itself	contain	prison	section	prefer	government	refer	mere					
always	figure	engine	relative	illustrate	opinion	minute	senate					
something	sudden	visit	progress	different	believe	ought	receive					
write	forty	guest	entire	object	system	absence	respectfully					
expect	instead	department	president	provision	possible	conference	agreement					
need	throw	obtain	measure	according	piece	Wednesday	unfortunate					
thus	personal	family	famous	already	certain	really	majority					
woman	everything	favor	serve	attention	witness	celebration	elaborate					
young	rate	Mrs.	estate	education	investigate	folks	citizen					
heir	chief	husband	remember	director	therefore		necessary					
dollar	perfect	amount	either	purpose	too		divide					
evening	second	human	effort	common	pleasant							
plan	slide	view	important	diamond								
broke	farther	election	due	together								
feel	duty	clerk	include	convention								
sure	intend	though	running	increase								
least	company	o'clock	allow	manner								
sorry	quite	support	position	feature								
press	none	does	field	article								
God	knew	regard	ledge	service								
teacher	remain	escape	claim	injure								
November	direct	since	primary	effect								
subject	appear	which	result	distribute								
April	liberty	length	Saturday	general								
history	enough	destroy	appoint	tomorrow								
cause	fact	newspaper	information	consider								
study	board	daughter	whom	against								
himself	September	answer	arrest	complete								
matter	station	reply	themselves	search								
use	attend	oblige	special	treasure								
thought	between	sail	women	popular								
person	public	cities	present	Christmas								
nor	friend	known	action	interest								
January	during	several	justice									
mean	through	desire	gentleman									
vote	police	nearly	enclose									
could	until		await									
copy	madam		suppose									
act	truly		wonderful									
been	whole		direction									
yesterday	address		forward									
among	request		although									
question	raise		prompt									
doctor	August		attempt									
hear	Tuesday		whose									
size	struck		statement									
December	getting		perhaps									
dozen	don't		their									
there	Thursday		imprison									
tax			written									
number			arrange									
October												
reason												
fifth												

This scale contains the 1,000 most commonly used words in the English language, arranged according to difficulty. Column A contains the easiest words; Column B is just a shade harder; second - grade pupils ought to make percentages ranging from 99 to 50 on Columns A to L. Third-graders should make 100 per cent on Column C; the second vertical line of figures shows the percentages to be expected of the third grade throughout; the third row gives normal fourth-grade percentages; and so on for the other grades. The scale was prepared for the Russell Sage Foundation from spellings by 70,000 children.

But spelling reform works slowly, and in the meantime foreigners and students must conquer the spellings of words as they are. People used to say, "He is a born speller," or "She is bright in everything else, but she cannot learn to spell." But spelling is not a trait which is without relation to general ability. Investigations have shown that those pupils who are highest in general scholarship make the fewest errors in spelling. It is largely a matter of careful observation and drill, as in any other subject.

In studying new words, practice the pronunciation first of all, in order to associate the sound of the word with its spelling. If you pronounce correctly, you will not write *prespiration* for *perspiration*, or *suprised* for *surprised*. Next, pick each word apart. Try to find the critical point in its spelling by asking yourself, "What is there to remember about this word?" The only difficult point about the word *thumb* is the silent *b* at the end. Fix your attention on that, connecting it with such words as *comb, lamb, dumb*. You will never forget how to spell *separate* if you connect it with *parade*, which contains the same Latin root.

In contrast to the old spelling methods, which required students to learn such words as *sciatica* and *porte-cochère* before they knew their meaning, the modern practice is to teach only those words which people need in an ordinary *writing* vocabulary. There are many words which we recognize in reading that the ordinary person never has occasion to use in writing. A writing vocabulary of 4,000 to 5,000 words is adequate for the most varied demands that are likely to be made on the average person, and 3,000 or 3,500 words carefully selected are all that should be taught in the elementary school.

One of the most valuable aids in the modern teaching of spelling is the 'Measuring Scale for Ability in Spelling', prepared by Leonard P. Ayres of the Russell Sage Foundation. This scale contains the 1,000 most commonly used words in the English language, classified according to difficulty. The spelling ability of any person may thus be accurately gauged by testing him with groups of words from the appropriate columns of this chart.

In general the spelling of each word must be learned by itself, but there are some rather simple rules that are of great assistance, in spite of the fact that there are exceptions to most of them. Some of these are given below:

If you are confused about whether to end a word in *-able* or *-ible*, try to think whether there is a noun related to it ending in *-ation*. If a word has a noun ending in *-ation*, the adjective generally also has *a* in its suffix, and ends in *-able*. Thus *accuse* has the noun *accusation*, and the adjective *accusable;* and we have *limitation, limitable; duration, durable; detestation, detestable*, etc. If there is no noun ending in *-ation*, the adjectives usually end in *-ible*, as *collectible, digestible, repressible*, etc.

To avoid confusion getween *ei* and *ie*, keep in mind the word *Alice*, in which you have *li* and *ce* to remind you that *i* follows *l*, and *e* follows *c*. This will help with words like *believe, relieve, receive, perceive*, etc.; but it applies only when the sound is long *e*. Otherwise *ei* is the more usual spelling, as in *deign, vein, rein, freight, height, sleight, foreign, counterfeit, heifer*. The following jingle is useful:

Use *i* before *e*,
Except after *c*
Or when sounded like *a*,
As in *neighbor* or *weigh*.

But remember the exceptions — *financier, seize, weird, either, neither, leisure, inveigle.*

contained in the Easy Reference Fact-Index at the end of this work

Words ending in *ie* (as *tie*), change the *ie* to *y* before the ending *-ing* (as *tying*).

Words ending in *y* after a consonant (as *sky*) change the *y* to *i* and add *es* to make the plural (*skies*).

Final *e* is dropped before an ending beginning with a vowel (as *seize, seizure; conceive, conceivable*), but retained before an ending beginning with a consonant (as *achievement, encouragement*). Exceptions: *judgment, abridgment, acknowledgment.* The *e* is also retained when it is necessary to keep the identity of a word (as *dyeing, shoeing, hoeing*), or to keep the soft pronunciation of a *g* or *c* (as *peaceable* and *changeable*). (*G* and *c* before *a, o,* and *u* are pronounced as in *gave* and *cat*; before *e, i,* and *y* they are pronounced as in *gentle* and *cent.*)

Monosyllables and words accented on the last syllable, ending in a single consonant after a single vowel, double the final consonant before a suffix beginning with a vowel. Thus *run* becomes *running, admit* becomes *admitted* or *admitting,* and *concur, concurrence.* But *profiting* and *benefiting* have only one *t* because they are not accented on the last syllable; and *conceited* does not come under the rule because there are two vowels before the last consonant.

SPHINX. Chiseled from solid rock nearly 3,000 years before the birth of Christ, the Great Sphinx of Egypt, like a gigantic sentinel, still guards the cemetery of Gizeh at the entrance of the Nile valley. It has the body and paws of a lion, but its head is a portrait statue of King Khafre, who built it and placed it before his pyramid tomb. "Wise as the sphinx" we sometimes say, and no wonder; for what secrets might not those lips of stone reveal could they but speak! For nearly 5,000 years it has crouched on the desert sands, gazing unmoved toward the east. Before its eyes generations, centuries, eras of history have unfolded; empires have grown up in splendid struggling power and have passed away in slow decay; the tide of civilization has swept forward, new religions have encircled the earth, new continents have been discovered, the world has been made over—yet the sphinx still stands patient and motionless in the tide of life.

Only one thing has changed the expression of that massive countenance. Grains of sand caught up by the hot swirling winds of the desert have kept up their tiny bombardment through the ages. Bit by bit they have scratched and chipped and rasped the solid rock until all the sharpness of angles and lines has melted away. The beard is gone; the nose is no more; the "graceful smile" described by visitors of old has vanished, leaving the strange inscrutable look which led the Arabs to call it the "Father of Terrors." Perhaps some desert vandals, some zealous Copts, enraged at the "pagan image," have helped to mar the surface of the figure, but the great mass of the body remains in crumbling outline defying time and man.

As we approach the sphinx where it looms between the river and the sands, we might mistake it for one of the many fantastic dull red and amber-colored rocks of the valley. At closer range this half-human,

THE GREAT SPHINX WATCHES THE CENTURIES PASS

The unblinking eyes in the worn, sand-chiseled countenance of the Great Sphinx still scan the horizon. In the distance rises the Great Pyramid of Gizeh, while in the foreground an Arab bows toward Mecca in prayer.

For any subject not found in its alphabetical place see information

half-animal colossus becomes evident for what it is and we ponder on "the mighty Pharaohs, and Hebrew law-givers, and Persian princes, and Greek philosophers, and Antony with Cleopatra by his side, and Christian anchorites, and Arab warriors, and European men of science, all brought hither in succession by the unpausing ages to look into those eyes—so full of meaning though so fixed!"

The head of the sphinx measures 19 feet from top of forehead to bottom of chin and 91 feet in circumference at the broadest part, with the shoulders and the upper portion of the paws extending forward about 50 feet. The mammoth body is nearly 150 feet in length, while the height from the ground to the top of the head is 65 feet.

Many attempts have been made to dig out the sands around the sphinx, and inscriptions have been found which show that a temple once stood between the massive paws. Smaller sphinxes exist elsewhere in Egypt, usually standing in pairs at the approach or entrance to a temple.

From the Egyptians the Greeks borrowed their idea of a sphinx, which they conceived as a monster with the head of a woman, the body and paws of a lion, and huge bird-like wings. According to the story, this monster put a riddle to all those who passed by, and devoured all who failed to guess it. After many had died in this way, the Theban hero Oedipus succeeded in solving the riddle and so caused the monster's death. (*See* Oedipus.)

The WORLD-WIDE *Search for* SPICES

How Pepper, Cloves, and Their Many Sharp-Flavored Cousins Have Made History, Inciting Discovery, Creating Commerce, Provoking Wars—The Precious Products of Tropical Climates and How They are Obtained

SPICES AND CONDIMENTS. If modern cold storage had been known in the days of Columbus, the New World might not have been discovered until centuries later. For without our modern means of keeping food palatable throughout the year, the Europe of the Middle Ages and later times found spices almost indispensable to flavor its poor and often half-spoiled food. In medieval England, for example, the usual winter diet consisted of meal and coarse salt meat, which became half-rotten by spring. So spices were in enormous demand to lend some savor to this monotonous and pleasureless fare. Cinnamon, cloves, and pepper were worth their weight in gold; and men risked their lives and fortunes in seeking new routes to the lands of spices—the East Indies and the neighboring parts of Asia.

For centuries these condiments, so common with us that we scarcely give them a thought, were among the most important articles of commerce. The spice trade was a leading factor in determining the rise and fall of states, in provoking wars, and in discovery and exploration. It was chiefly the desire to find new ways of access to this vastly profitable trade that led to the discovery of sea routes to the east and the discovery of America. Arabia was at first the great distributing center for spices, which were brought overland in great caravans. Venice rose to world power through her control of the Mediterranean trade in spices and other imports from the East. When Venice lost command of the trade through the discovery of new sea routes to the East, first Portugal, then Holland, rose to wealth and power largely through the spice monopoly.

In the days of Queen Elizabeth the Dutch went so far in their efforts to keep all the spice trade in their own hands that they cut down clove, cinnamon, and pepper trees in districts not directly under their control and inflicted the severest punishments on anyone who attempted to infringe on their monopoly. In Ceylon, the great cinnamon center, death was the penalty for the illegal sale of even a single stick of cinnamon; and this law remained in force until the English took the island in 1796. It was largely to break the grip of the Dutch on the profitable spice trade that the East India Company was formed in England, thus laying the foundations for British rule in India.

Most of our spices still come from the East Indies and the neighboring lands. Pepper, cardamom, and cinnamon are native to India and Ceylon; nutmeg and mace, cloves, clove-bark, turmeric, and ginger come from the Malay Archipelago; cassia bark from China. Africa gives us grains of paradise, the pungent seeds of a plant used largely in early days as a substitute for pepper, while the American tropics have supplied vanilla, red peppers, and the clove-like pimento or allspice. The colder climates of northern Europe and Asia have produced but few—coriander, cumin, caraway seed, parsley, mustard, and calamus root.

Many of these aromatic substances have other uses besides that of flavoring agents. Some are valuable in perfumery, confections, and scented soaps, as vanilla, cloves, and pepper, or in the manufacture of incense, as cinnamon. Many are utilized in medicine, as cardamom, ginger, nutmegs, oil of cloves, etc. Turmeric is used in dyeing, especially by the natives of India and China, and marjoram serves in dyeing wool. Other spices are used in various arts.

It is a remarkable fact that a large proportion of the spices are successfully grown only on islands, or near the sea. Nutmegs, cloves, vanilla, cinnamon, and cardamom may be termed island plants, and long before the "spice islands" are in sight, sailors know they are in the vicinity by the heavy fragrance borne to them by the land breeze.

The flavor of spices is due to the presence of aromatic oils secreted in the plant, but these oils are richest in different parts of the various plants. In cloves and capers, it is the flower buds which are particularly aromatic; in coriander, capsicums, and pepper, it is the fruit. The ginger, licorice, and turmeric of commerce are roots or underground stems, and cinnamon and cassia are the inner bark of a tree. In most of the savory herbs—sage, mint, thyme, marjoram, etc.—the leaves are richest in these essential oils, while nutmegs, caraway, and anise are seeds.

When the flower buds are utilized they are plucked just before they are ready to break into blossom. The whole clove, as we get it in the shops, is the dried flower bud of a small bushy tree. The four petals are closed into a tight ball, held by four fleshy sepals. One of the early uses of cloves is recorded in an ancient Chinese court order, wherein the officers of the court are required to hold cloves in their mouths while addressing the sovereign. Capers, which are used as a seasoning for sauces, etc., are the salted and pickled buds of a bushy plant which grows wild on the mountainous slopes bordering the Mediterranean Sea. The flower is "sensitive," opening when the sun strikes it, and closing again as the sun sets, so the flowers must be gathered very early in the morning, between daybreak and sunrise.

Cinnamon is the dried inner bark of several species of trees. This aromatic bark has long been popular, having been highly prized in biblical times. Resembling it in flavor is its close relative, cassia bark. Cassia buds, the dried unripe fruit of the cassia tree, are also used.

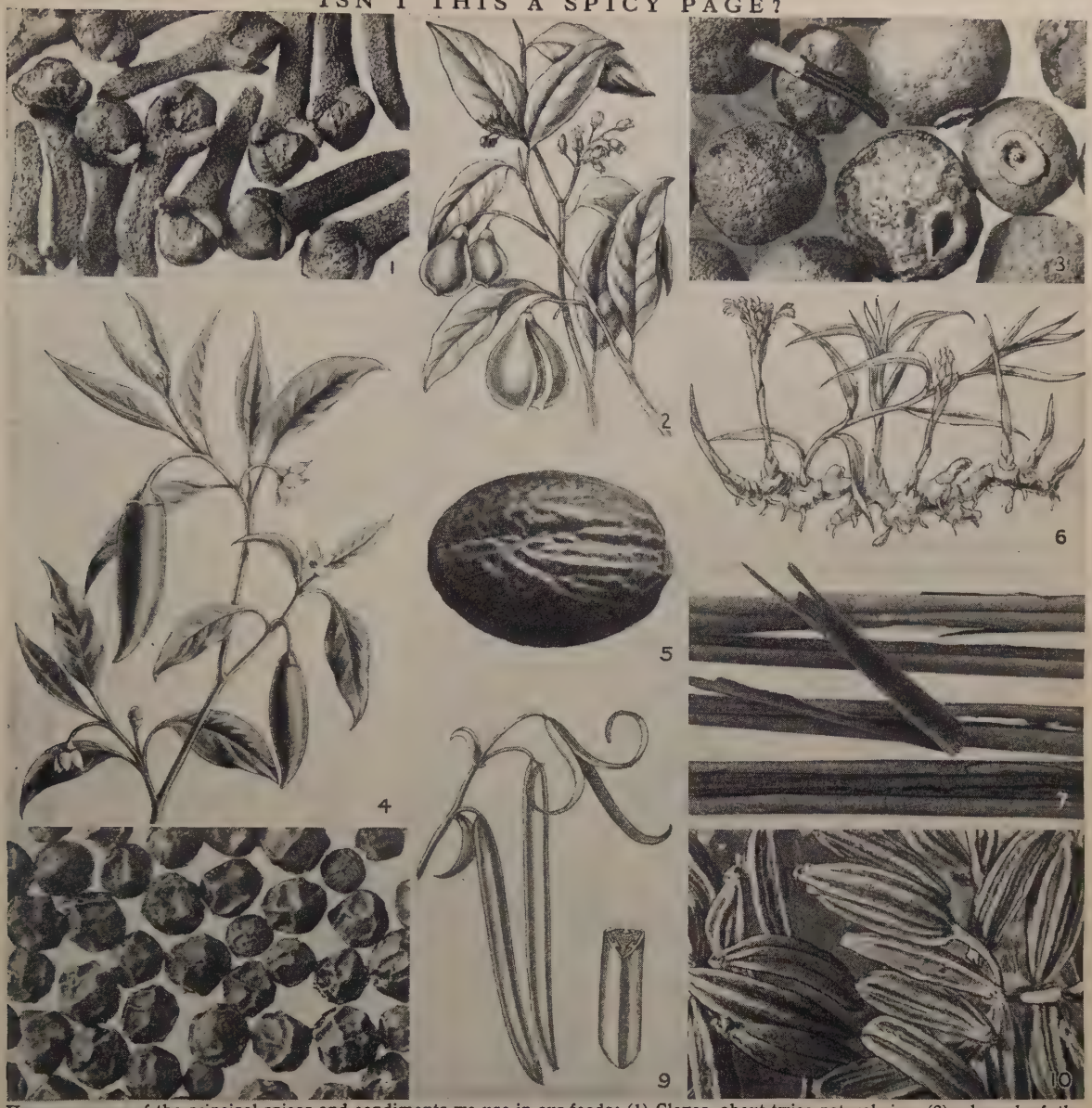
Pimento or allspice—not to be confused with the pimiento (*see* Pepper)—consists of the little unripe fruits of a tree which resembles the clove. The spice takes its popular name from its resemblance in perfume and taste to a mixture of cinnamon, cloves, and nutmeg, and with them forms the four spices to be found in every kitchen. The fruit is about the size of a black currant and resembles peppercorn. The word pimento is taken from the Spanish word *pimienta*, meaning "pepper."

Coriander is one of the oldest spices, being mentioned in early Sanskrit and Egyptian writings. It is the fruit of a small herb growing on the shores of the Mediterranean, and is largely cultivated in India. It is valued as an ingredient in confectionery, to disguise unpleasant tastes in medicines, and as an ingre-

DRYING CLOVES IN A "GARDEN OF SPICES"

The flower buds of the clove tree, gathered by hand, are spread out on mats to dry in the sun, being sometimes previously dried by exposure to the smoke of wood fires. When first gathered they are reddish, but drying turns them a deep brown.

ISN'T THIS A SPICY PAGE?



Here are some of the principal spices and condiments we use in our foods: (1) Cloves, about twice natural size; (2) a branch of the Nutmeg tree, much reduced, showing flowers, leaves and fruit; (3) Allspice berries, highly magnified; (4) a flowering and fruiting branch of Red Pepper; (5) a Nutmeg; (6) a growing root of Ginger; (7) a few strips of Cinnamon bark; (8) Black Pepper berries, somewhat magnified; (9) Vanilla beans — the pods are seven or eight inches long; (10) Caraway seeds, highly magnified.

dient in curry powder, "the salt of the Orient," which is a mixture of powdered sago with various spices. One of the spices often used in curry is the cumin, which is also used as a substitute for caraway seed in seed cakes. Dill, commonly known in the East Indies as cake seed, is the dried fruit of a plant which grows as a weed in southern Europe. It is used in pickling, the most familiar use being for "dill" cucumber pickles.

Another group of seasoning plants is cultivated in gardens as kitchen herbs, their aromatic flavor being especially valued in meat cookery. Among these are the sweet-smelling common marjoram, thyme, whose fragrant leaves and flower-tips are so well liked in seasonings and sauces, and tarragon, used fresh or dried for pickling and for spicing vinegar. Savory, whose fine peculiar flavor is used in pickling, sauces, etc.; sage, whose distinctive taste gives zest to the dressing with which the Thanksgiving turkey is stuffed; and parsley, cultivated for its finely cut aromatic leaves and used for flavoring soups and for garnishing, are all well known flavoring plants. Bay, the dried leaves of a large evergreen shrub of the laurel family, is used in many forms of cookery.

contained in the Easy Reference Fact-Index at the end of this work

The ROBBER BARONS of SPIDER LAND

Nature's Most Expert Spinners and Weavers—Ingenious Ways in Which They Get a Living—Their Fairy-like Webs

SPIDERS. There's a lesson in spiders, a lesson that touches closely on human affairs. If we contrast the spider and the bee, we see the same difference that there is between ancient anarchy and modern civilization. The spider is the robber baron, the pirate, the solitary bandit of the animal world. The bee is the organized worker, the respectable member of society. We praise and protect the bee but we usually destroy the spider, just as the robber barons were destroyed by the kings when the modern states of Europe were forming.

Yet despite their lawlessness men have always had a certain admiration for the Robin Hoods and Captain Kidds of history if they were skilful and bold. In the same way, if we study the ways of spiders instead of killing them, we shall find them among the most interesting of living creatures. Also we shall discover that only a few of the rarer species are poisonous to man, that even these will bite only when molested, for spiders love above all things to mind their own business.

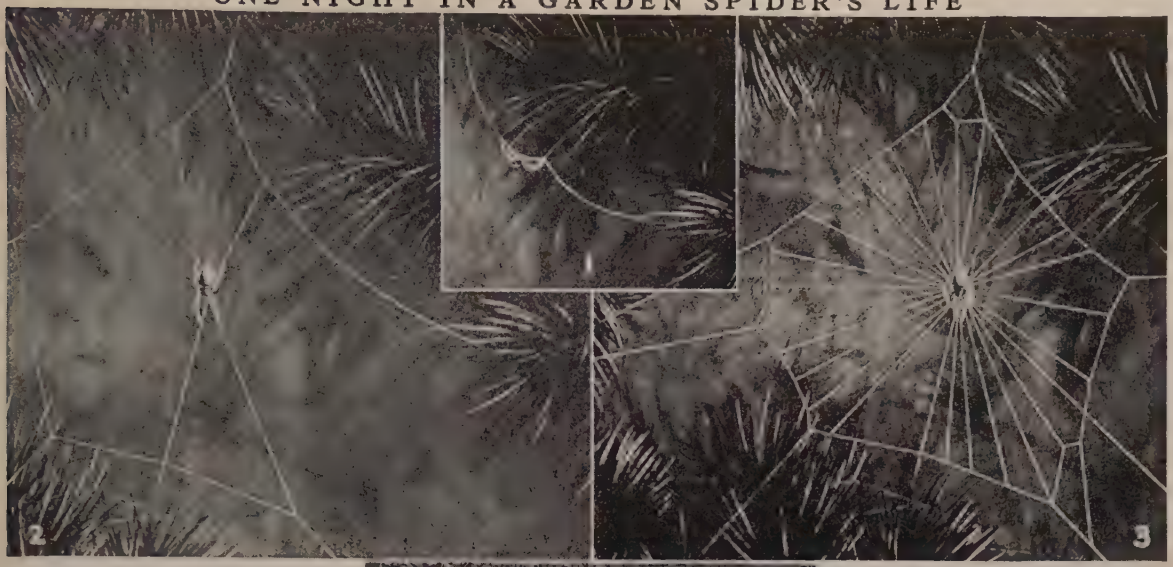
In their single-handed struggles for existence spiders have developed a wide variety of amazing instincts for concealing themselves, for protecting their young, and for capturing their prey. This last is of the utmost importance, for all spiders are carnivorous, feeding only upon creatures they have caught.

Except in the Arctic regions and on the tops of the highest mountains where there is no insect life as food supply, spiders are found in all parts of the world, even in remote islands. Some catch their prey by speed of foot, some by leaping like tigers from ambush, some by means of the marvelous silken nets they spread in their victim's path. There are skilful miners and carpenters among spiders, and turret builders and expert swimmers and divers and others that can walk on the water. There are even aeronaut spiders, which travel great distances through the air in home-made parachutes of spider-webs.

Spider webs are of many kinds and shapes. Some are formed like funnels, others are closely woven sheets with the appearance of tissue paper; but the most beautiful and conspicuous structures are the wheel-shaped orb-webs, woven with geometrical precision.

The common garden spider is among the most skilful of the orb-web builders. You can find such a web in almost any garden, stretched across a fence corner or between the low branches of stout shrubs. The lady of the house sits in the middle of her parlor awaiting visitors. Stand out of

ONE NIGHT IN A GARDEN SPIDER'S LIFE



These are actual flash-light photographs of a web under construction. Four and a half hours elapsed from the time Mrs. Spider began until she finished, but she was temperamental and loafed three-fourths of the time. After hanging the first cable (1), she built a sort of frame (2), in which she fitted spokes, as in a wheel (3). To hold the spokes in position a spiral around the center was added (4), and finally the web was ready for its prey (5).

sight—and remember she has several eyes in her head and can see all around the compass—and fling a bit of dry leaf on the web. She darts out. She views that leaf with disgust, thinking the wind has played a trick on her. Very likely she will push it overboard, for she keeps her house clean and shining. But toss into the web a fly or other insect, and see the great difference in the behavior of the spider.

When a hard rain or wind comes along, the pretty house may be wrecked. Then you may watch the spider build it again. She has to do it before breakfast, too, or go hungry. She sits out on a leaf or twig or fence post, looking over the building site.

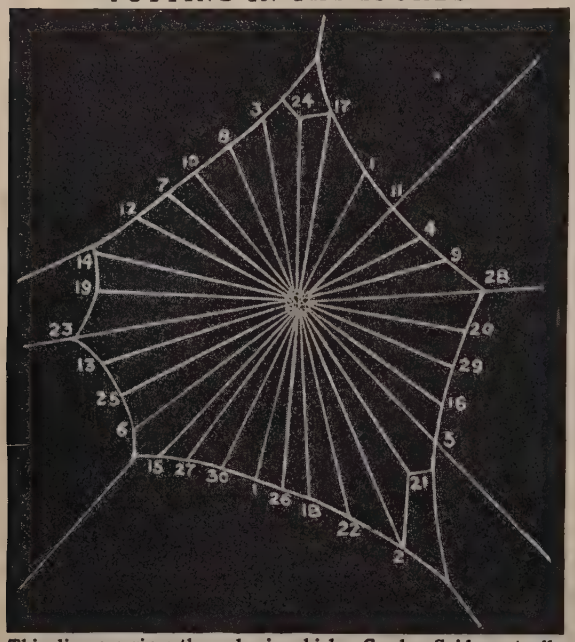
She drops, or jumps, from one support to another, paying out a tiny gray silk cable behind her, and fastening it wherever she can. Soon she has an irregular space inclosed. Do you know how fine those lines are? You would have to lay four or five thousand of them side by side, to make a ribbon an inch wide. You can see her run around those lines and pull them with her hind foot to test their strength. If one breaks she spins another.

Soon she has her space cut into four nearly equal parts like the quarters of a pie. Then she spins other spokes across the center or the wheel web. The many crossings make a stout hub. Starting at this hub, she weaves a spiral line, crossing the spokes and gluing the joints. The spiral is carried around four or five turns. This is the temporary scaffolding, made of tough dry threads like the spokes.

Now she starts near the outside edge of the wheel and circles around toward the center. This time she uses a much better silk. It is studded with little sticky beads. It is this thread that catches and holds the feet of unwary insects. As she travels back to the hub, the spider cuts the scaffolding away. When the new sticky spiral is complete, she spins new support lines from the outer rim of the web to the supporting branches and pulls them tight until the whole structure is as

taut as a drumhead. It hasn't taken more than an hour to make the web. If it is destroyed the spider seems to have plenty of material to build another.

PUTTING IN THE SPOKES



This diagram gives the order in which a Garden Spider actually put in the spokes in the web shown on the preceding page. You see that she did not go around the circle, but carefully added the spokes in such order that the strength of the net would be gradually increased without putting too great a strain on any part of it.

It is the female who does all this work. You will nearly always find her living alone. The male is very much smaller than she is, and he is not much of a worker. As the female bees do all the work, and drive the drones or males out of the hives, or even kill them, so the female spider barely tolerates her mate and even eats him if other food is scarce. She builds her own house, catches her own food, looks after her young, and lives most of the time in a busy solitude.

Myth and the Magic Web

A long time ago the work of this clever spinner and weaver was looked upon as pure magic. The Greeks made a wonder story about her. The spider was a maiden named Arachne. In a contest of spinning and weaving she proved herself better than the wise goddess Athena. To punish her for daring to be more clever than a goddess, Arachne was turned into a spider, and told to spend the rest of her days making her wonderful webs. It is because of this story that the scientific name *Arachnida* was given to the spider and its relatives, the scorpions, harvestmen (daddy-long-legs), mites, and ticks.

Sometimes you will find a spider's web bridging a small stream. How was the first thread carried across on which the web hangs? The spider simply waited until the wind was in the right direction, then mounted to a high branch and released a long free thread. It was carried over by the breeze and became tangled to the shrubs on the other side, then was drawn tight and fastened. Provided with this first cable path across the chasm, the spider found it easy to stretch the other foundation lines.

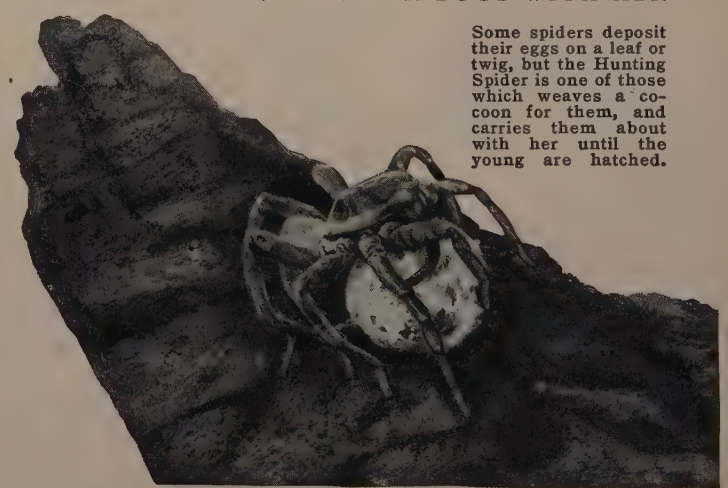
"Will You Walk Into My Parlor?"

Many spiders do not live on their webs, but hide in small woven nests near by. From the center of the web they stretch a tight trap-line to their den. This acts like a door-bell announcing visitors. A grasshopper, perhaps, jumps into the net. He sticks and struggles; the trap line jerks; out comes the spider like a flash across the web. Quickly she fastens a broad swathing band to the big floundering insect; then by a few dexterous kicks she rolls it over two or three times, and it is securely swathed in a tight shroud; a quick bite with her poison jaws completes the work. The grasshopper is then carefully carried to the hidden den and sucked dry.

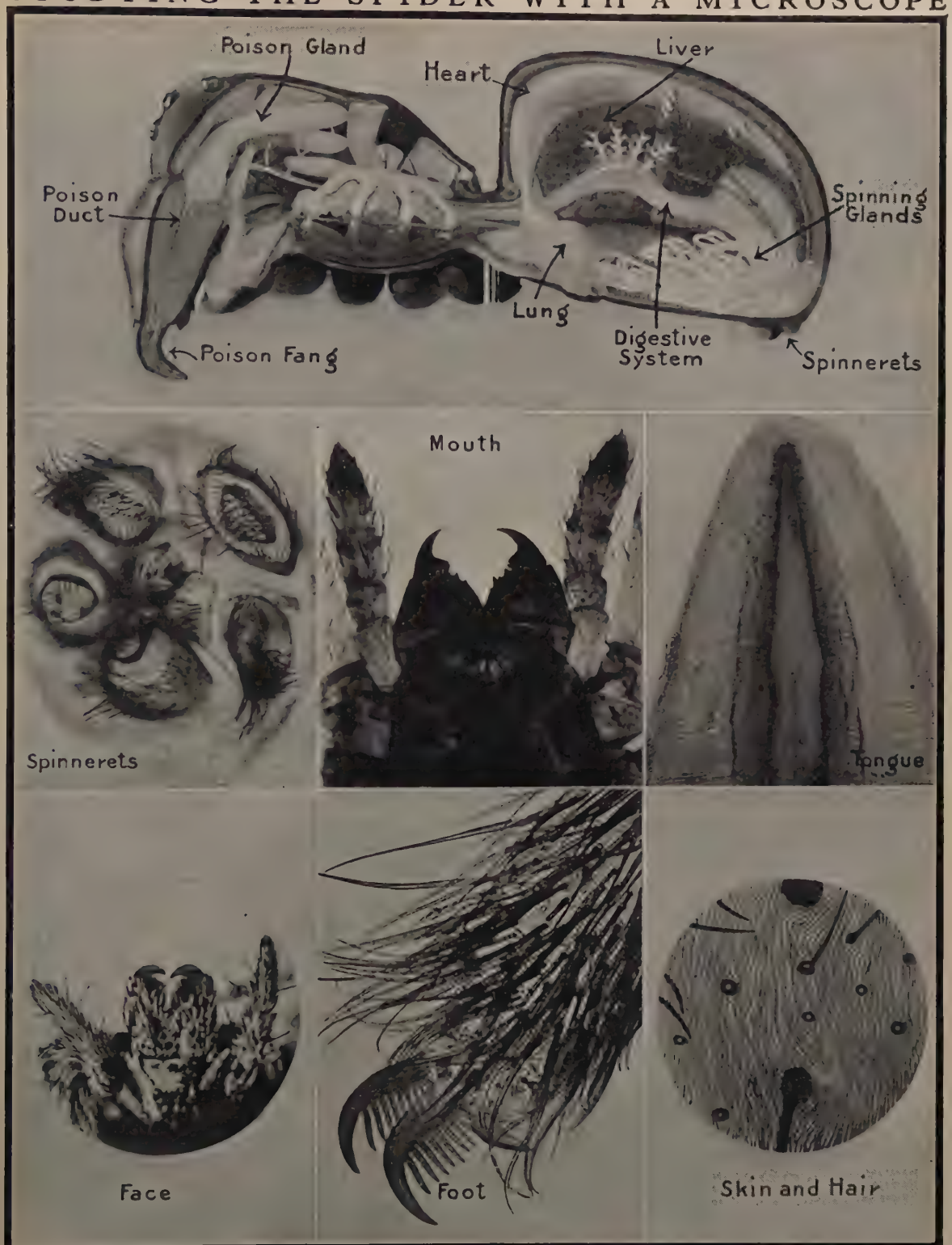
Spiders use their silken threads for many other purposes than spinning webs. Sacks are woven to carry eggs, and are either fastened to a leaf or twig or are carried about by the mother until the young hatch. Many species then transport the baby spiders on their backs until the youngsters are old enough to look out for themselves.

The interesting trap-door spiders, which dig holes in the ground and conceal the opening with hinged covers, line the inside of their tunnels first with a coating of saliva and earth and then with a layer of silk. The door may be a simple flap of silk and dirt, or it may be like a thick cord with edges accurately bevelled to fit the opening, so that when it is shut, one cannot distinguish it from the surrounding earth. On the inner surface of the door are tiny holes

CARRYING HER EGGS WITH HER



Some spiders deposit their eggs on a leaf or twig, but the Hunting Spider is one of those which weaves a cocoon for them, and carries them about with her until the young are hatched.



All of the photographs on this page are many times magnified, so that you may see exactly how a spider is built. The noteworthy features of the internal structure are the poison ducts, which end in the curved claw (*chelicerae*) in front of the mouth, and the spinning glands, which terminate in the spinnerets. All that part of the head which is visible when the spider is seen directly from the front is called the face. The spider can swallow only liquid foods. After it wounds its prey with its sharp claws and kills it by the poison flowing from the duct in the under side of the claw, the spider sucks the victim dry, and casts aside the hard parts.

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and grooves which receive the claws and jaws of the spider when it is holding the door closed against its enemies. Some of the doors have elastic hinges and snap shut when the occupant goes out on a hunting expedition.

In Europe lives a species called the raft-spider, which builds tiny flat-boats of leaves and twigs lashed together with its silken cables. These are launched on the surface of some quiet pond when the spiders wish to make a raid upon water insects. The bold skipper often leaves the ship and runs out over the surface of the pool to catch hovering flies, or dives below to seize a toothsome water creature.

Even more ingenious is the true water spider which lives among the plants at the bottom of clear quiet ponds. There it builds a thimble-shaped dome of waterproof silk, fastened mouth downward to the stem of a plant or wedged in the crevice of a stone. Then it goes to the surface and catches air bubbles on the hairs of its stomach and between its legs and carries them down, brushing them off into its submerged cell until it is filled to the brim with air. To this home the water spider brings whatever prey it catches. Here too its eggs are laid and hatched, out of the way of all enemies.

A PORTABLE SPIDER NURSERY

The Wolf Spider drags her egg-sac with her when she hunts prey. Then when her young are hatched, they crawl on her back, and are carried around, papoose-like, until they are strong enough to shift for themselves.

But perhaps the most remarkable of all are the aeronautic spiders. Long before the invention of balloons or of airplanes, these spiders had solved the problem of aerial navigation. On a hot day the spider-balloonist climbs to the top of a bush or a fence post or merely to the summit of a clod of earth. There it lifts up its abdomen and spins out a thread which is carried upward by the air rising from the warm ground. Other threads are added to the first one, and perhaps spun together into a little fluffy cloud of gossamer. The breeze tugs at the airship, the spider lets go of the launching platform, hanging from its balloon by a slender thread, and away it sails, perhaps to travel for days before it comes to earth again. Ballooning spiders have been met by ships hundreds of miles from land. When they want to descend they spin out a drop-cord until it reaches the landing place. The spider, of course, is always at the lower end of the thread she spins.

A TRAPDOOR LETS HIM IN AND KEEPS ENEMIES OUT

At the left you can see Trapdoor Spiders in the security of their burrows. The doors, neatly hinged and carefully beveled to fit the openings, open at the slightest touch from below, and spring shut again when pressure is removed. At the right is a spider, safe in his hole, holding down the door, so that his arch-enemy and cousin, the centipede, cannot get in.

For any subject not found in its alphabetical place see information

The safety devices and food-getting tricks of spiders are endless in number. Certain crab-spiders hide in flowers and seize insects that come for honey. The wandering wolf spider leaves his underground castle with the turret built about the entrance and runs down his prey in an open race. It is to this family that the famous tarantula of southern Europe belongs, the bite of which was supposed to cause the dancing madness called *tarantism* (*see* Tarantula).

The Dangerous Dance of Courtship

Whether or not spiders ever made any human being dance, it is certain that many of them are addicted to dancing themselves. Certain male jumping spiders, which are covered with hairs of brilliant colors, perform the most extraordinary antics before the females, leaping and swaying and displaying their beauty. Usually these dancers remain at a safe distance or approach with great caution, for if they fail to find favor they are likely to be pounced upon by the female and eaten.

Spiders vary greatly in shape and size. Some are no bigger than the head of a pin, while others, like the giant bird-spider of South America, have bodies measuring up to three inches in length and legs expanding seven inches. These monsters, which belong to the tarantula family, have been known to catch and kill small birds, mice, snakes, and even fish.

A BIRD-CATCHER FROM SOUTH AMERICA

The Bird-Spider is the largest species known. Some have bodies three inches long, and their strong hairy legs have a spread of 7 or 8 inches. They feed on insects and small birds.

SNARED IN HER OWN WEB

This remarkable photograph shows a spider's web covered with hoar-frost, and the spider herself frozen at her post.

Spiders often fight fiercely among themselves, and the battles usually end in the death of one and a cannibal feast for the other. Should the vanquished, however, escape with minor injuries, such as losing a leg or two, it need not worry, for these remarkable creatures grow new legs when needed.

As a commercial product spider silk has been found to be superior to the best silk spun by silk-worms; but the difficulty of getting spiders to live peaceably together, as well as the almost impossible task of inducing them to spin freely in a confined space has so far prevented the silk's being used on any extensive scale for manufacturing textiles. Spiders' threads are used, however, for the delicate cross-hairs in telescopes and other optical instruments, and for similar highly technical purposes requiring extra fine strands of great relative strength.

Spiders belong to the order *Araneida* of the class *Arachnida*. This class, as we have seen, includes also the scorpions, harvestmen or daddy-long-legs, mites, and other less familiar forms. The *Arachnida* in turn are included in the big group or phylum of the *Arthropoda* or creatures with jointed legs—the most numerous group of living creatures, for in it, besides the *Arachnida*, are the insects, the crustaceans, such as crabs, lobsters, shrimps, etc., the centipedes, and the millipedes.

Although often called so, spiders are not insects. All insects have six legs, no more and no less, whereas spiders have eight legs. Unlike the insects, also, the head and thorax of spiders are consolidated in one segment, called the *cephalothorax*, which is connected with the abdomen by a slender stalk, the *pedicel*.

In the place of the antennae or feelers of insects, spiders have at the front of the head two clawlike appendages called *chelicerae* with which they seize their prey. Near the tip of each claw is the opening of the poison glands.

Spiders may have from two to eight eyes, depending on the species. Two types of eyes are distinguished: the "nocturnal" eyes, especially suited for seeing at night, when many spiders do most of their working and hunting, and the "diurnal" eyes, adapted to daylight vision. (For illustration, *see* page 1215 in article on Eye.)

Another set of organs fastened to the heads of spiders are the two *pedipalps*, which are sometimes mistaken for an extra set of legs. These are usually used for holding the spider's struggling prey.

A SPIDER WHO VENTILATES HER WATERY HOME

The Fresh-Water Spider builds her nest among the weeds or plants of lakes and ponds. The nest is usually thimble-shaped, with the opening always downward. When the nest is completed she swims to the surface, catches a bubble of air between her legs, carries it down to the nest, and there releases it, thus forcing out a little water. She repeats this operation until the nest is filled with fresh air.

The four pairs of legs of spiders are attached to the thorax. Each leg consists of seven segments and ends in two or three sharp claws.

The spinning organs are situated near the rear of the saclike abdomen on the under side. They consist usually of three pairs of "spinnerets" to which is added in certain spiders another organ, the *cribellum*. Small spinning tubes, sometimes a hundred or more in number, are distributed over each spinneret, and through them the silk is expelled from the body. The *cribellum* when present is used to spin broad bands of silk composed of many slender threads.

SPINNING AND WEAVING. Among the wonders of modern industry the great textile mills, turning out miles and miles of beautiful fabrics a day, have a high place; and the marvelous machines which they employ are among the triumphs of the inventor's skill. But fundamentally cloth-making involves only two processes—spinning and weaving—both of which man had discovered long before he had learned to write and before recorded history began.

Spinning consists in drawing out and twisting the prepared fibers of flax, cotton, wool, or other materials, so as to form thread or yarn suitable for weaving. Weaving, in turn, is the art of interlacing lengthwise yarns ("warp") with crosswise yarns ("weft" or "woof") so as to produce cloth.

For thousands of years the only means of spinning were the spindle and distaff, such as are pictured on the monuments of ancient Egypt, and such as may still be seen in the hands of peasant women in many backward parts of the world today. The prepared fibers were loosely bound to the end of the "distaff" (a short stick) which was held in the left hand or stuck in the spinner's belt. The notched end of the "spindle" was then caught in some of the fibers on the distaff; these were drawn out by the spinner's hands, and twisted into yarn by setting the dangling spindle to rotating, a "whorl" of stone or clay being attached to its opposite end to assist this operation. When a yard or so of yarn was thus spun, it was wound about the shaft of the spindle and fastened and the operation was repeated. Threads of wonderful fineness have been fashioned in this primitive way. The cobweb-like muslins of India were woven

of thread so fine that 253 miles of it were spun from a single pound of cotton. The spindle used was of bamboo, about as long as a darning needle, and lightly weighted with clay.

Toward the middle of the 16th century the spinning wheel was invented. While the principle is identical with that in spinning with the hand spindle, the spindle is mounted and given a uniform motion by being attached to a wheel. During the 18th century several notable inventions completely revolutionized spinning by enabling the operator to spin many threads at the same time. (*See* Arkwright; Crompton; Hargreaves.) Today great factories with power-driven "mule spinners" and "ring spinners" enable a single operative to spin more yarn or thread in a day than was possible with 10,000 or more spinning wheels before 1750.

In weaving, the primitive hand-looms of the most ancient days gradually became better built, but no notable improvement was made until the invention of Kay's "flying shuttle" in 1738. This was very useful in weaving wide cloths ("broad-cloths"), for it returned of itself when thrown between the threads of the "warp" with its attached "weft," and did not require the services of a second person on the other side of the loom. It was not until 1785 that Cartwright patented the first power-loom, from which all our automatic looms of today are developed. (*See* Cartwright.) Even before the invention of the power-loom, what is called the "Jacquard loom" was invented (named after a Frenchman who improved it) for figured weaving. (*See* Lace.) It operated by means of a complicated system of perforated cards which let through needles that raised and lowered the warp threads as was required to produce the elaborate designs of damask and other figured weaves. The essential principles of this machine remain in use in the highly specialized power-looms of today. (*See also* Cloth; Cotton; Silk; Wool.)

SPIREA (*spī-rē'ȧ*). In meadows and gardens throughout all the temperate parts of the Northern Hemisphere we find the pretty flowering shrub called the spirea. All of the varieties—about 60—bear graceful clusters of tiny white or pink flowers. The plumy bridal wreath, with its dainty drooping blossoms, the fragrant meadowsweet, and the woolly-leaved steeplebush or hardhack, which bears dense erect spirelike clusters of blossoms, are among the best known. The last named is so abundant in many parts of the country that it is a troublesome pasture weed.

THE BRIDAL WREATH

The best-known variety of Spirea is the Bridal Wreath, which gets its name from the fact that in a temperate climate it reaches full bloom in June, "the bride's month."

The spirea's five-petaled flowers grow in clusters. It is a large genus of the family *Rosaceae.* Scientific name of meadowsweet, *Spirea ulmaria;* of hardhack, *Spirea tomentosa.*

SPIRITUALISM. Can the spirits of the dead communicate with the living? The belief that they can and do has been widely held at all times and among all peoples. In modern times this belief has crystallized into an organized doctrine which we call spiritualism.

The modern spiritualistic movement began in the United States in 1848, when members of a family named Fox in Hydesville, N. Y., reported that they heard in their house mysterious knocks, which conveyed messages through an alphabet system discovered by a daughter of the family. The messages purported to come from the spirit of a murdered peddler. Kate Fox and her sister Margaret at once began interpreting messages from the "spirit world" and became the first "mediums," as those persons are called through whom the supposed spirits send messages.

Within a few years, spiritualism spread to all parts of the United States and Europe. Mediums sprang up on all sides, and "seances" or spirit meetings multiplied. Besides the rapping noises, musical sounds were heard, tables moved, mysterious lights appeared. The mediums asserted that in the trance-state they communicated with the spirits of the dead, and many persons received what they believed to be news from dead relatives. By 1880 the movement had grown large enough to attract the careful attention of scientists.

In 1882 the Society for Psychical Research was organized in England to investigate the facts of spiritualism. It was found in the first place that a great many mediums were frauds. Among mediums who could not be accused of deliberate trickery, the society found a large number who excited themselves into a condition of ecstasy, during which they used unconscious deceptions upon themselves and others (*see* Hypnotism). But the difficulty of explaining the astonishing results produced by the apparently sincere and genuine mediums remained just as great, except in those cases which can be explained as instances of telepathy or mind-reading.

An interesting experiment undertaken by the late Prof. William James of Harvard University, won world-wide attention. In the presence of his associate, Prof. Josiah Royce, and other members of the Harvard faculty, he sealed up in an envelope a paper on which was written a statement known only to the great philosopher himself. The letter was locked away in the university vaults. The agreement was that, after his death, if it were possible, he would communicate the contents of that letter to Professor Royce or to any other person then living who could receive the message. Professor James died in 1910 and the letter he wrote lies in the university vaults, its contents still a secret.

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SPOKANE (*spō-kăn'*), WASH. Plunging in two leaps over ledges 200 feet wide and 130 feet high, and descending into the heart of Spokane's business district, is the beautiful workaday cataract of the Spokane River—a branch of the Columbia—whose harnessed power, constantly grinding wheat, turning lathes, running railways, and operating mines, has done much to make this city famous. Spokane is the eastern gateway to the state of Washington, lying in a beautiful valley only a score of miles from the Idaho border.

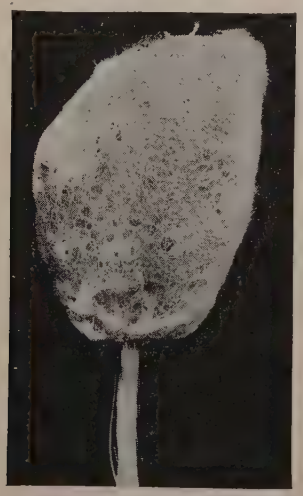
Nature has richly endowed the region in which Spokane is placed. To the north and east are mountains in which each year are mined some $40,000,000 in gold, silver, copper, zinc, and lead. Great forests of white pine timber lie near at hand, and stretching to the west and south are agricultural lands, noted for their fruit, grain, and stock-raising. Five continental railways enter Spokane on their own tracks and radiate like spokes of a wheel in all directions, making the city the distributing point for this great region. In size Spokane is second only to Seattle in the state, with a slight lead over Tacoma.

Spokane is located 1,891 feet above the sea, in the valley, half plain and half mountain, of the Spokane River. Its progressive business district lies in the lower part, while its many attractive residences, gardens, and parks are perched up on the slopes. Within the city limits the river is spanned by 23 bridges, the most interesting one being a 281-foot single span of concrete, one of the longest of its kind in the United States.

The first permanent settlement on the city's site was made in 1874 and named Spokane Falls for the Spokane Indians who once lived in the region. Spokane is an Indian name meaning "children of the sun." In 1881 the city was incorporated, and after the Northern Pacific Railway reached it in 1883 its growth was rapid, in spite of a $5,000,000 fire in 1889. A commission form of government was adopted in 1910. The city is 225 miles east of Seattle. Population, about 105,000.

From the OCEAN FLOOR *to Your* BATH TUB

The Strange Life of the Water Animals Whose Skeletons Help Us Keep Clean



This is the Glass-Rope Sponge, remarkable for the strand or rope, composed of long twisted spicules which look like glass threads, by which the sponge anchors itself in the mud.

SPONGES. Sponges have been known for thousands of years, and are spoken of in Homer's 'Iliad'. Yet it is only within the past 50 years or so that they have certainly been known to be animals and not plants. Like plants they are always fixed and never move about and they have not eyes nor other sense organs, nor legs, nor any of the internal organs, that we usually think of as belonging to animals. Yet they have the mode of feeding, and type of egg cells and their development, that belong to animals. And in other obscure ways they resemble animals and not plants.

Of course this means *living* sponges. Perhaps you are thinking of what we usually call "sponges," which are only the dry skeletons of sponges. In life these were all filled in and covered over with the soft jelly-like flesh of living cells.

Sponges of all kinds always live in water. Most of them are sea forms, but one family is common in fresh water in most parts of the world. The marine forms live mostly in shallow water, down to a few hundred feet deep; but some live in the deepest seas.

Sponges are of many sizes and forms and colors. One is very simple, an inch or less in length, and branching like a delicate bit of sea-weed. Another is like a small vase a half-inch long. Others still are in the form of big vases a foot or more in diameter. "Finger-sponges" often grow on oyster beds and look somewhat like a many-fingered hand. The wonderful "Venus's flower-basket" is about the size and shape of a banana. Ordinary bath sponges when living have much the size and shape that we know from their skeletons, with the firmer smooth end attached, and the softer rough end free.

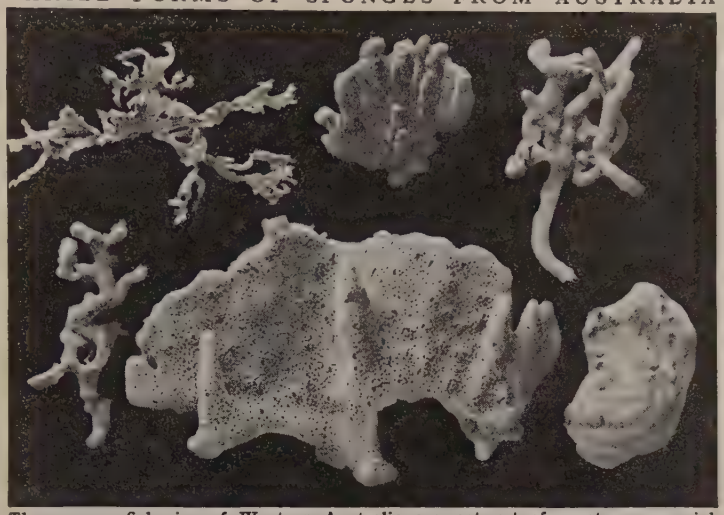
The sharp spicules of this sponge are tiny lustrous white fibers. This is one of the Glass Sponges, so named because their skeletons are made of silica, one of the constituents of glass.

Some sponges live only attached to other animals like crabs; and some branching tubelike forms burrow into oyster shells for their homes. Fresh-water sponges live mostly on the under side of stones and floating objects, in ponds and slowly flowing streams. They are spreading squashy objects, yellow or green in color, and it is hard to think of them as animals. But this is just another case where we have to change our ideas of things!

For any subject not found in its alphabetical place see information

Even aside from their useful purposes, the skeletons of sponges are among their most interesting and important parts. In the ordinary bath sponges, the skeleton is of hornlike material and forms an intricate complete meshwork of varying degrees of fineness. In others, the skeleton consists of needle-like rods and fibers of limy material, interlocked in intricate ways. In others still, the fibers and rods are of flinty material. The wonderfully beautiful skeleton of the "Venus's flower-basket" is made of flinty fibers intertwined and interwoven in ways so delicate and intricate that one wonders that such a simple and lowly creature as a sponge could have formed it and had it for its skeleton. Of course, when we speak of skeleton, we don't mean that it is at all to be compared with our own—only that it serves to give support and protection to the sponge. Although sponges are in most ways very simple animals, they are rather difficult to understand, for they are so different from the animals with which we are familiar. One very simple type is just a small narrow tube a half-inch long, attached at one end, with the outer or free end open. A thousand invisible pores admit water to the chamber within. This chamber is lined with very peculiar small cells, each one provided with a lash which keeps the water moving in through the small pores, and out through the large one. This water contains oxygen for breathing,

VARIED FORMS OF SPONGES FROM AUSTRALIA



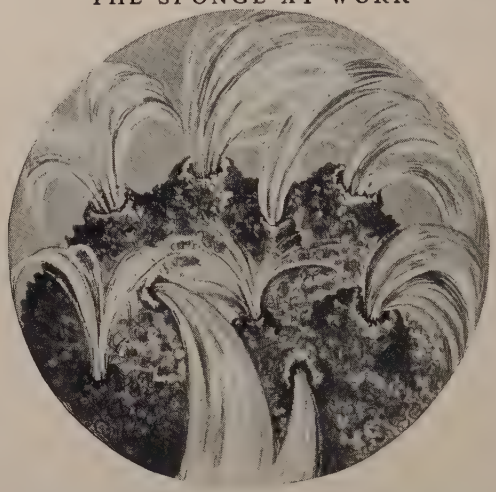
The sponge fisheries of Western Australia are not yet of great commercial importance, but they supply all varieties from the smaller ones which look like seaweed or like a cluster of worms to the larger complex "glass" sponges.

GIANT SPONGES FROM THE WEST COAST OF FLORIDA

These would make very rough bath sponges, but they are fine for washing windows, cleaning machinery, and other heavy work. They were only a small part of one day's "catch" delivered at Tarpon Springs, Fla., which is the greatest shipping point for sponges in the world. The Florida sponges are usually coarser and not so durable as those from the Mediterranean, but the Florida sponge fisheries are commercially much more important because their yield is much greater.

and very minute particles of food which are swirled into the cells to be digested. In large sponges millions of pores admit the water to intricate systems of branched canals on the inside, which have tiny chambers lined with the feeding cells. The canals lead like flues to the larger chimney-like openings and so to the outside. It is these large holes that we usually see in ordinary sponges.

THE SPONGE AT WORK



The only work the Sponge does is to feed, and the sea really does this for him, because he gets all of his food out of the currents of water which enter his body through pores opening into internal chambers or tubes. The surplus water and waste pours out through another set of larger openings.

Sponges as you usually know them are not single animals, but "colonies" of several or many. The original very small single sponge formed buds, much like the budding of twigs on plants. But the individuals were so knit together that one couldn't tell just how much belonged to each animal of the common mass. Ordinary small sponges, three or four inches in diameter, are composed of a half-dozen to a dozen individuals with closely interlocking fibers.

Sponges are also developed from very small egg cells a thousandth of a inch in diameter. The egg develops into a very small creature which swims about free for a short time, and then settles down for life and proceeds to grow.

Sponges are never eaten by other animals, probably because sponges the world over have a peculiar disagreeable odor and perhaps flavor. But other animals of many kinds live *in* sponges for their homes—worms, small crabs, mollusks, etc.

While sponges of many kinds are found in all parts of the world, those adapted to commercial uses are rather limited in their distribution and abundance. Profitable sponge fisheries are found especially in the eastern parts of the Mediterranean, the Bahama Islands, and on the coasts of Florida. The "sheeps-wool" sponges of Florida are of especially fine quality, but other kinds are found there also.

Profitable sponge fishing must be in comparatively shallow water. They are obtained by diving, dredging, and (in very shallow water) by means of a long-handled fork. The men mostly work in pairs in rowboats—one rowing, the other scanning the bottom through a "water glass."

Sponges are easily prepared for the market. When put into water and allowed to stand, the flesh soon decays away, and the skeletons are readily washed out and cleaned. With slight trimming and sorting they are ready for the market.

Sponges grow rapidly. Sometimes grounds stripped one year are profitable sources of supply the next. But there is always danger of injury to the sponge industry from over-fishing, and from the destruction of young specimens. Special legislation has been passed to prevent these evils.

The United States government has experimented with the use of "cuttings" in the propagation of sponges commercially, for these attach themselves and grow. So far there has not been much success.

Sponges form a division of the animal kingdom called the *Porifera.* They always live in water, attached, and in some ways are the simplest of many-celled creatures. One of the most common bath sponges is *Euspongia officinalis;* the glass-rope sponge is *Hyalonema mirabilis;* the "Venus's flower-basket" is *Euplectella aspergillum.*

SPRAYING. The damage done to the farm crops of the United States annually by insect pests reaches the enormous sum of a billion dollars. Insects hungry from their winter fast prey upon the first tender shoots and other insects feed on the leaves, suck the plant juices, which are the life blood of the plant, bore their way through the scented petals of the flowers, and even lay their eggs in the fruit, so that the young may feed upon and destroy the crowning product of plant life. Other agents which cause crop losses are the bacteria, responsible for the wilt of melons and cucumbers, tomatoes and potatoes, and for blights such as that which attacks the pear; and the fungi, small parasitic plant growths, such as the scabs on apples and potatoes, smut on corn, and rusts and smuts on small grains. (*See* Rusts and Smuts.)

Left to themselves these plant enemies would soon make fearful inroads on our most valuable crops, but fortunately there are many ways of combating them. Spraying the surface of plants with solutions that will protect them from the attack of both insects and fungi is one method that has long been in use in farm and garden, orchard and vineyard. Used against insects such a solution is called an "insecticide," and one which destroys fungus growths, a "fungicide."

If the insects belong to the group which chews or bites off portions of the plant, as do the worms and beetles, they may be destroyed by poisoning the surface of the plant with solutions such as Paris green, white helebore, and London purple. If they suck the sap or plant juices, as do the plant lice, scale insects, plant-bugs, thrips, and leaf-hoppers, they are destroyed by caustic solutions—such as the kerosene emulsions, soap washes, lime and sulphur, and tobacco sprays—that burn the bodies of the insects and

suffocate them by closing their breathing tubes or spiracles. Poisons may be applied as powders dusted over the leaves by use of a bellows, but more often they are mixed with water and applied in liquid form. The solution may be sprinkled on with a whisk broom or by syringes; but power spraying machines are now used in large orchards and vineyards, and hand sprayers in gardens and small orchards. It is important that the material be applied evenly to prevent injury to the leaves of the plant, and over as much surface as possible to do the most harm to insects.

The fungicides may also be either dusted or sprayed upon the infected plants. The one most generally used is called "Bordeaux mixture," so named from the accidental discovery of its usefulness in Bordeaux, France, in 1882. The fungicides destroy the delicate tissues of the fungus growth without injury to the "host," as the plant upon which the pests feed is technically called.

The struggle against plant enemies is never ended. Millions of dollars are spent on sprays and spraying outfits every year. Men working through the Department of Agriculture and agricultural experiment stations and colleges devote their time to discovering new means of combating them. The farmer finds it to his advantage to clear his fields of all dead stalks and rubbish which might harbor the insects on the field during the winter. Fall plowing and disking uncover the buried grubs and insects housed in the soil, exposing them to the birds that prey upon them and to the cold of winter. Rotation of crops prevents the insect pests from feeding upon their favorite crop year after year and multiplying in numbers with each season. Ditches are sometimes dug around a field, and the migrating insects that fall into them are then killed by the use of kerosene, or are caught in a sticky substance put there for the purpose. Spread of disease in the orchard is checked by pruning and burning the diseased branches, and "gassing" is also a most effective method used in recent years. A fruit tree is covered with a tent or bag, which is then filled with a poisonous gas that kills the insects. This is done without spotting or harming the tree or its fruit in any way.

The following are some of the most important insecticides and fungicides:

Paris green (one pound in 100 to 300 gallons of water)—used in destroying the potato beetle; may be used alone or in compounds with arsenate of lead, if a quicker-acting solution is desired.

Arsenate of lead (4 to 10 pounds in 100 gallons of water)—can be applied in stronger mixture than Paris green or other arsenical poisons without injury to foliage.

Kerosene emulsion (two gallons of kerosene added to hot soapsuds made by dissolving one-half pound of soap in a gallon of hot water)—an inexpensive caustic solution made of materials which are easy to procure.

Lime and sulphur wash (15 pounds of sulphur and 20 pounds of lime mixed in 50 gallons of water)—used to destroy scale insects; also valuable as a fungicide.

Bordeaux mixture (3 to 6 pounds of quicklime and a like quantity of copper sulphate, in 50 gallons of water)—one of the best fungicides; has the advantage of being cheap.

Copper carbonate solution (one ounce of copper carbonate dissolved in ammonia and mixed with 9 gallons of water)—used on ornamental shrubs and ripening fruits instead of Bordeaux mixture, because it is clearer and leaves no stains upon the plants.

Nicotine sulphate solution (40 drops to each quart of water) is another useful spray.

It is important to see that the pump has sufficient power to reduce the mixture to a very fine mist, and that the nozzle distributes it evenly. Persons not familiar with the preparation and use of sprays would do well to consult their state agricultural experiment station, as it requires experience to make up the solutions and use them satisfactorily.

Spring. When ground-water (water which has sunk beneath the ground) issues from beneath the surface through a natural opening in sufficient quantity to make a distinct current, it is called a spring. In general, springs are due to the accumulation of water underground by a layer of impervious rock. In such cases the water must find some outlet. Such an outlet may occur in a valley or upon a hillside; in a valley where such a valley dips into the ground-water, and on a hillside where the water runs along the slope of a bed of rock or clay to the place where the bed "outcrops" or comes to the surface. When the water is forced upward under pressure it is called an artesian spring. Artesian wells are merely deepened artificially assisted springs (*see* Artesian Wells). Springs that rise from a great depth are generally permanent; but many springs are intermittent, others quite variable. The largest springs may indicate the exit of considerable subterranean rivers.

Mineral springs often become health resorts and fashionable "watering places," such as Spa, in Belgium (where the use of the name "spa" for such a resort originated); Baden, in Germany; Karlsbad, in Bohemia; Bath, in England; Saratoga Springs, in New York; Virginia Hot Springs, Va.; White Sulphur Springs, W. Va.; and French Lick, Ind. When hot springs occur at a distance of hundreds of miles from any volcano, it is probable that the waters have sunk far into the interior of the earth—several thousands of feet—have there been warmed by the earth's internal heat, and are brought again to the surface by what is called "hydrostatic pressure." A hot spring which throws forth columns of water and steam is called a "geyser" (*see* Geyser).

Springfield, Ill. Springfield, the capital of Illinois, will ever be a place of pilgrimage for admirers of Abraham Lincoln, for it was here that he lived during the stirring times just preceding his election as president, and here, in a beautiful mausoleum in Oak Ridge Cemetery, his body is entombed. The house in which he lived and his tomb are the property of the state, and are visited every year by thousands.

Springfield is very nearly in the center of the state, on the Sangamon River. It is in the midst of an extensive coal mining and agricultural region, and has large manufacturing interests. There are several parks, of which Washington, Lincoln, and Bunn Parks are the largest. The state Capitol, completed in 1887, stands in a park of eight acres, and the New Centen-

nial Building, commemorating the celebration in 1918 of the hundredth anniversary of the state's admission to the Union, adjoins it to the south; the latter houses the State Historical Library and Memorial Hall, which contains the state military relics.

Springfield was settled in 1819, and became the state capital in 1837. Population, about 60,000.

SPRINGFIELD, MASS. Two travelers, an Englishman and an American, were looking out over the Rhine valley from the tower of the Strasbourg cathedral. "Have you ever seen anything more beautiful?" exclaimed the American. "Only once," said the Englishman. "Where?" "From the top of the tower in Springfield, Massachusetts, looking over the Connecticut valley to the Berkshire Hills." "Why—why," stammered the American, "I live in Springfield, but I have never seen that view."

The campanile tower, 300 feet high, which commands this wonderful view over the Berkshires, is only one of the group of public buildings in which Springfield takes pride. The auditorium seats 4,000 people; the courthouse and several other buildings are notable pieces of architecture, designed by H. H. Richardson. The art museum contains one of the best collections in the country. Among the many fine public monuments in the city is Saint-Gaudens' famous 'Puritan'. The companile tower and the auditorium, mentioned above, are combined with a handsome administration building to form a "municipal group."

Situated on the Connecticut River, just east of the Berkshire region, Springfield mingles the old New England spirit of culture with a vigorous modern industrial life. The *Springfield Republican*, established by Samuel Bowles in 1824, and one of the most influential newspapers in New England, is published here. Among the varied products are firearms, bicycles and motorcycles, steam and electric cars, skates, revolvers, sporting goods, buttons, electrical apparatus, rubber goods, automobile tires, cotton and woolen goods, tools, candy, machinery, envelopes.

Springfield was first settled in 1636. In 1675, during King Philip's War, it was attacked by Indians and burned. It was the scene of riots during Shays' Rebellion (1786–87). The Continental Congress established a government arsenal and armory at Springfield during the Revolution. Springfield muskets were used by the Federal forces during the Civil War, and until the World War of 1914–18 the Springfield arsenal was the chief source of small arms for the United States army. The standard army rifle is still commonly called the "Springfield." Population, about 130,000.

SPRUCE. These cone-bearing evergreen trees, widely distributed in northern Europe and America, are often considered a branch of the firs, which they closely resemble. The spruce or spruce-fir (genus *Picea*), however, differs from the ordinary firs in having curved needles set all around its smaller branches, instead of in flat rows as is the case with the fir tree.

A RED SPRUCE AND ITS DISTINGUISHING MARKS

The Spruce, one of the cone-bearing evergreens, can be easily distinguished from the Fir, its nearest relative, by its needles, which grow all around the smaller branches instead of in flat rows, and also by the cones, which hang from the branches instead of standing erect, as in the case of the Firs.

American boys of former generations know the spruce (especially the black spruce) as the source of a gum which they formerly gathered for chewing purposes. From its tender twigs also was made a "spruce beer" similar to the root beers of today. Other familiar American species are the blue spruce, red spruce, and white spruce. The so-called Douglas spruce or Douglas fir, one of the giant trees of the Pacific coast, which often attains a height of 300 feet, is neither a spruce nor fir, but a pine.

The finest of all European spruces is the Norway spruce, a magnificent tree attaining a height of 80 to 150 feet. From it are obtained resin, turpentine, tar, and lampblack. In Sweden and Norway, where it is most prevalent, the inner bark is used for the manufacture of baskets, and from the prepared roots is woven a good quality of rope. The lumber is very valuable and is shipped throughout Europe.

Spruce timber is highly valued in shipbuilding, for it affords the finest masts and spars in the world, combining strength, lightness, and elasticity in unusual degree. Spruce is also the chief wood from

which paper pulp is made. It is unsurpassed for airplane construction, because it is not merely the toughest of soft woods for its weight, but possesses great shock-absorbing qualities. It has the added advantage of not splintering when hit by a missile. During the World War the vast stands of Sitka spruce (*Picea sitchensis*) in Oregon and Washington became the chief sources of airplane supply for both the United States and the Allied nations.

SQUASH. Squashes, pumpkins, and gourds belong to one big puzzling family. Gourds, with their white blossoms and hard inedible fruit, are easily identified; but pumpkins and squashes, cultivated so extensively for the thick-fleshed edible meat, have become badly confused.

L. H. Bailey, in his 'Lessons with Plants', tells how we can distinguish between a pumpkin and a squash by a glance at the stem. If it is ridged and furrowed, or if it flares at the point where it joins, the fruit is a pumpkin, but if it is soft, spongy, and cylindrical, not enlarged at the junction, it is the stem of a squash. You will find by applying this classification that many fruits we have always known by the name of "pumpkin" are really squashes, and many we have called "squashes" are pumpkins.

If the name squash belongs to one group more than another it is to *Cucurbita maxima*, to which species belong the Hubbard, Marblehead, Sibley, and Turban squashes. The field or common pie pumpkin is *Cucurbita pepo*. The "vegetable marrow," so highly prized in England, and also the "summer squashes"—the Scallop, Pattypan, and the Crookneck types—are all varieties of the pumpkin species. On the other hand, the Cushaws, Canada Crooknecks, Japanese Crooknecks, Dunkards, and "sweet potato" squashes belong to still another species (*Cucurbita moschata*), and are probably native to Asia. In England all varieties of pumpkins, squashes, and gourds are often called "gourds." (*See* Gourds.)

SQUID. A mollusk of the cuttlefish family, with ten arms or tentacles bearing suckers. Usually squid are small, and they are much used for bait by North Atlantic fishermen. The giant squid, which is the "octopus" or "devil fish" of fiction, sometimes attains a length of 55 feet and a weight of 1,000 pounds. An observer on a whaling ship describes a deadly conflict which he witnessed between a large sperm whale and a giant squid almost as large as itself, whose interminable tentacles seemed to enlace the whale's whole body. The latter's head, especially, seemed a network of writhing arms and it appeared to have the tail part of the squid in its jaws and to be sawing through it in a business-like methodical way. The black eyes of the squid, which contrasted with the livid white head, were at least a foot in diameter. (*See* Cuttlefish, Squid, and Octopus.)

SQUIRREL. Among our wild animals none are better known than these pretty bright-eyed graceful little creatures, which are now as common in city parks as in the forests and country places.

A FLYING SQUIRREL AT REST

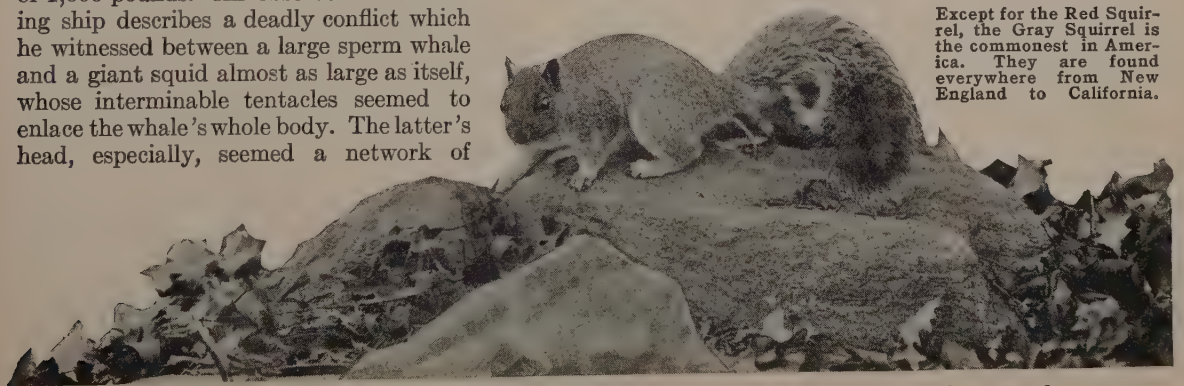
This Flying Squirrel is just about to leap. Notice how prominent his hind leg is. When he starts to leap he spreads his legs apart, forming a sort of parachute.

Laws have been passed to protect them; children, older people, and even dogs have learned not to molest them; and as a result the squirrels have come to trust us and are among our best friends.

The squirrel, as he frisks up and down the trees, chattering gaily, is the cheeriest of companions. If you try, you can coax him up to you by holding out to him a nut or other bit of food. At first he may scamper away as soon as he gets the nut. But when he comes to know you, he will sit up on his haunches before you to eat it, handling it adroitly with his fore feet and cutting through the shell with his sharp teeth. In time he may even become bold enough to help himself out of your pockets.

Some member of the squirrel family may be found in almost any part of the world except Australia. The numerous species, which belong to the order of rodents, or gnawing animals, fall naturally into two great divisions—the ground squirrels and the tree

THE FRIENDLY LITTLE GRAY SQUIRREL



Except for the Red Squirrel, the commonest in America. They are found everywhere from New England to California.

squirrels. The ground squirrels include the ground-hog or woodchuck, the prairie-dog, the striped gophers, and the chipmunk, which are described in separate articles.

A SQUIRREL AVIATOR "TAKING OFF"

This Flying Squirrel is just setting sail, or in the technical language of aviators, is "taking off." When fully spread out he covers so much area that the atmosphere nearly supports him.

There are several varieties of tree squirrels, differing in size and color, but all having the characteristic slender agile body and long bushy tail. They live in the trees, building their nests either in the branches or in hollow trunks. They feed mainly on acorns and nuts, but occasionally eat animal food and birds' eggs.

The red squirrel, so called from its rusty red color, is the smallest of the tree squirrels. It is not more than eight inches long, with a tail of six inches or less. It is found in most of the wooded parts of North America north of Mexico, and is common in the forests of Canada and the northeastern United States. The red squirrel is the liveliest, the nosiest, and also the most mischievous of the squirrels. In New York and New England he often quarrels with his neighbor, the gray squirrel, and is even known to drive these rivals out of a grove which they inhabit together. He also has the bad habit of robbing birds' nests and eating the eggs and young.

The Douglas squirrel of British Columbia, Oregon, and California, which is a relative of the red squirrel, has a somewhat better reputation, but is also noted for his chattering, frolicsome nature. Like the red squirrel, besides his scolding chattering notes he has a real song. In the Douglas squirrel the upper parts of the body are dark brown and the lower parts lighter and of a more reddish cast.

The gray squirrel is perhaps the best known of the North American squirrels. It ranges from Nova Scotia to Florida and westward to the treeless plains. It is nearly twice as large as the red squirrel and is more graceful in build. The color is mainly gray, often with a brownish or rusty tinge, and sometimes almost black. Friendly and active and merry, but not so vociferous and impudent as the red squirrel, the gray squirrel is a general favorite.

The fox squirrel is larger and heavier than the gray squirrel, and much less graceful. Fox squirrels vary greatly in color. The Southern fox squirrel is of a grayish brown with pure white nose and ears. The rusty fox squirrel, whose name indicates its appearance, inhabits the upper Mississippi and Ohio valleys.

The squirrels of Europe, though similar in color and in some other characteristics to the American species, are not closely related. The skins of the gray squirrel of Russia and Siberia are much used for fur, and this is the only squirrel fur that has commercial value. The squirrels of the tropical regions are noted for their brilliant colorings and beautiful markings.

The most extraordinary of all the squirrels is the flying squirrel, which is found in temperate and tropical regions in various parts of the world. It has a peculiar extension of skin connecting the fore and hind legs. This is loose and capable of being drawn out when the legs are extended, so as to form a parachute. Thus the animal can take long sailing leaps from higher to lower branches in the trees, sometimes covering nearly 20 yards. In North America, there are two species inhabiting the eastern part of the continent—one

THE INDIAN GIANT SQUIRREL

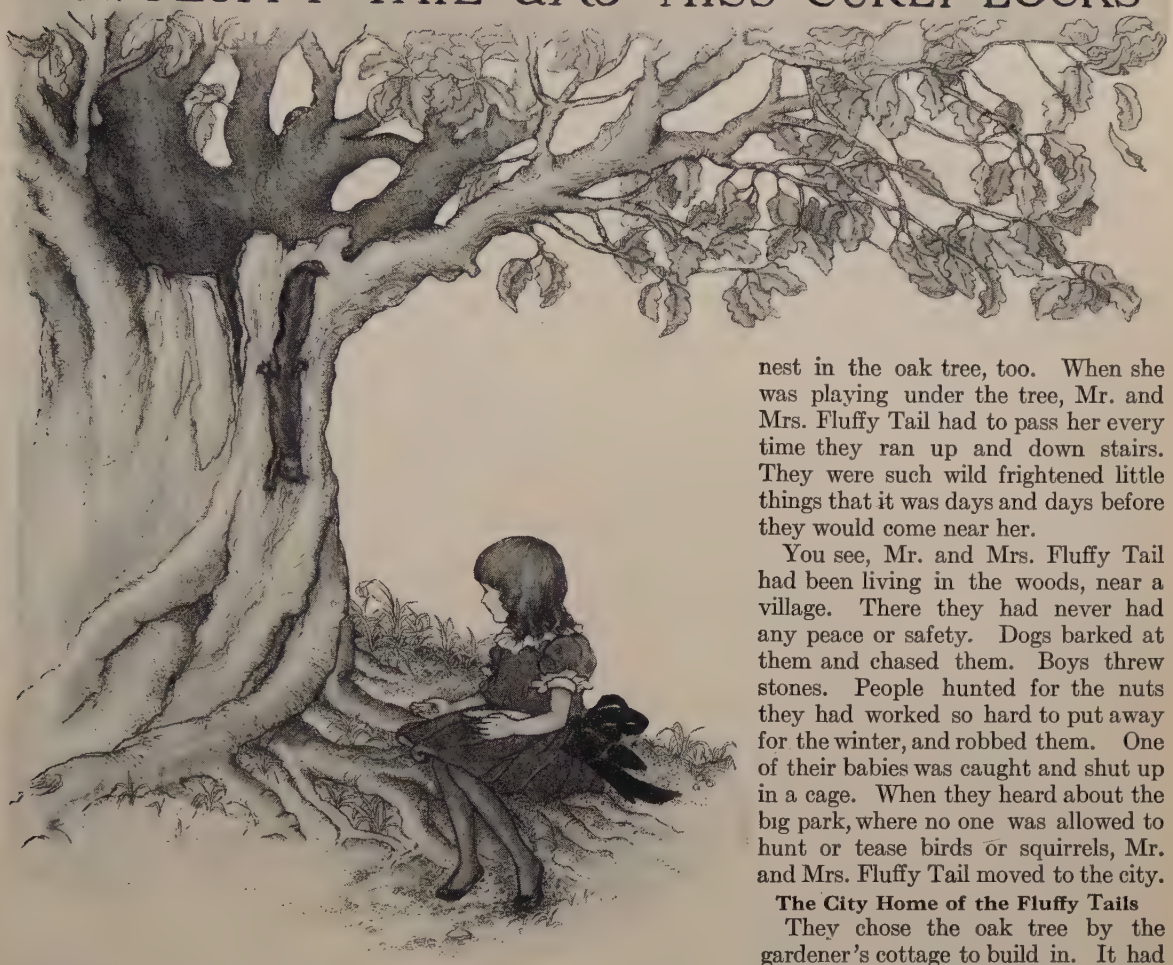
He gets his name from his size; his body is not less than a foot long, and his heavy bushy tail is twice that length. He is sometimes called the Malabar Squirrel, from the southwestern part of India where he is most common.

bluish-gray and about 13 inches long and the other larger and glossy brown; there is also an "alpine" species which inhabits the high slopes of the Rocky Mountains.

Scientific name of red squirrel, *Sciurus hudsonicus;* of Douglas squirrel, *Sciurus douglasi;* of gray squirrel, *Sciurus carolinensis;* of fox squirrel, *Sciurus niger;* of flying squirrel of eastern United States, *Sciuropterus volans.*

For any subject not found in its alphabetical place see information

MR. FLUFFY TAIL and MISS CURLY LOCKS



THE very first time Curly Locks saw Mr. Fluffy Tail, he was sitting up on his hind legs, eating an acorn. He was a little gray squirrel, only ten inches long. Really he was a warm sunny gray, for there was quite a bit of brownish-yellow in his pretty coat. His tail, which was as long as all the rest of him, arched like an airy plume over his humped-up back.

"Chirp, chirp!" he cried in great alarm when he saw Curly Locks, and he flashed up a tree. His tail waved behind him like a gallant little banner. He was gone so quickly that he might have been a wood fairy.

Curly Locks was the luckiest little girl! Her papa was head gardener of a big city park. So she lived right in the park, in a gray-stone and brown-wood and red-tile roofed cottage. A gnarly old oak tree shaded the cottage. A pair of bluebirds had a nest there, in a knot-hole. Curly Locks liked the shade of the oak tree when the sun was hot. Everyday she brought her dolls out, to play on the grass. That is how she knew right away, when a pair of squirrels built a nest in the oak tree, too. When she was playing under the tree, Mr. and Mrs. Fluffy Tail had to pass her every time they ran up and down stairs. They were such wild frightened little things that it was days and days before they would come near her.

You see, Mr. and Mrs. Fluffy Tail had been living in the woods, near a village. There they had never had any peace or safety. Dogs barked at them and chased them. Boys threw stones. People hunted for the nuts they had worked so hard to put away for the winter, and robbed them. One of their babies was caught and shut up in a cage. When they heard about the big park, where no one was allowed to hunt or tease birds or squirrels, Mr. and Mrs. Fluffy Tail moved to the city.

The City Home of the Fluffy Tails

They chose the oak tree by the gardener's cottage to build in. It had rough bark to which their tiny claws would cling as they scampered up and down. And it had a hollow place in it big enough for a squirrel pantry.

For furry animals, Mr. and Mrs. Fluffy Tail built the oddest house. It was set high up, in a fork of the tree, and was woven of moss, twigs, dry leaves, and feathers, like a bird's nest. And like their nearest neighbors, the bluebirds, they had to hurry to get their nest ready for babies. Every summer from three to five little Fluffy Tails came to live with them, and they stayed until next spring.

They were very much alarmed at first when they found they had another neighbor in little Miss Curly Locks. Sometimes, when she came out to play, they were very careful to run up and down the other side of the tree. Sometimes they dropped from a high limb. They never were hurt. They always came down on their feet, top side up, like little kittens. A little later they grew bolder and leaped over her head.

"Oh, you darling little dears! Don't be afraid of me. I wouldn't hurt you for anything." She flung a handful of popcorn to them. They sat up on their

hind legs and looked longingly at the good food, but they would not touch it. The popcorn was gone the next morning, and Curly Locks was so glad that she clapped her hands. By and by the wild little things would learn to trust her, and be friendly.

Picnic Life in the Park

That time came very quickly. In the early summer there was not much in that clean city park for squirrels to eat, for old acorns and beechnuts were raked away by the gardeners. Mr. and Mrs. Fluffy Tail nibbled tender shoots and twigs, and ate winged maple seeds. Sometimes they found corn and oats by the duck pond; but the ducks quacked and scolded so loud that they were frightened away. Very often they would have gone hungry but for little Miss Curly Locks. She nearly always had popcorn or peanuts or crackers for them.

By and by they were sure it was quite safe for them to sit up and eat the food when she was there. Mr. Fluffy Tail picked up a peanut with his fore paws. Then he sat up on his hind legs and ate it. His fore paws were like little hands, with four fingers and thumb. His hind paws were feet, with five toes. He held the nut with both hands. He cracked it with his strong teeth. Then he picked out the kernel and popped it into his mouth.

When he had had enough to eat for one time, he carried the rest of the nuts away and buried them under the bushes. He carried the nuts in cheek pouches, in his mouth. Two nuts in the pouches made Mr. Fluffy Tail look as though he had the mumps. He buried each nut in a different place, and scratched the earth over it. No one could tell where he had hidden it. Then when he was hungry, he just dug up a lunch.

Mr. and Mrs. Fluffy Tail became so friendly with Curly Locks that they often asked her for food. They came within a few feet of her, and rising on their hind legs they begged like little dogs. When they did that, she threw two nuts to them. If they wanted more they had to beg for them. Every day they came nearer. At last they took food from her hands. After that they were never afraid. They even leaped to her shoulder. They hunted for nuts in her pocket and her hat. One day they found an animal cracker. They sat up and nibbled all around the edges of the crackers, so exactly like babies with cookies that Curly Locks laughed out loud.

Curly Locks and the Five Babies

It was a happy day when they brought five teeny-weeny fluffy-tailed babies down the tree to see their little girl friend. They all played tag. They chased each other up and down and around the tree. They ran races across the grass. The baby squirrels learned to crack peanuts. They were all as curious and teasing as monkeys. They helped themselves from the dollies' tea-table. Every sunny day, Curly Locks watched the little family at their frolics. Soon she watched them flying about their task of getting in food for winter, and storing it away.

Autumn had come, with wind and rain and frost. The air was full of red and yellow leaves. Acorns, beechnuts, and pine cones packed with oily seeds lay on the ground. Even the baby squirrels were busy gathering nuts. Filling their cheek pouches they scampered up the tree to the deep hole near the nest. It took many days of hard work to fill the storehouse.

Then they had to gather twigs and moss and dead leaves, and feathers dropped by birds, to weave a roof over the nest. That was to keep out rain and snow. A door was left, just big enough to squeeze through. Curly Locks noticed that the Fluffy Tails were growing winter overcoats, too. Their fur grew long and thick to keep them warm.

When winter came she did not see much of her furry friends. They really slept a good deal of the time, like little bears. Sometimes, on bright days, they came down the tree for a frolic. They left their tiny footprints in the snow. Curly Locks often pressed her nose against the cold window-pane and looked up at the snow-covered nest in the leafless tree. She felt so sorry.

"Mother dear," she said, "just see how their poor little raggedy house rocks in the wind. The Fluffy Tails must be nearly frozen."

They were not. Indeed, they were as snug as could be. When the weather was so cold that their paws might be nipped, they scampered down into their pantry and went to sleep again. Even if their nest had been blown away by the wind, they would have had a warm place in that hole.

Making a Party for the Fluffy Tails

One day Curly Locks had such a happy thought that she clapped her hands. She made a party for the Fluffy Tails in a sunny bay window-sill. She popped a popper full of corn, and turned it out on the window-sill. The wind must have been just right to carry the news, for the squirrels seemed to smell the food. They came flying down the tree. They sat upon the snow and sniffed, wrinkling their funny little noses. In another minute they were up in the window enjoying the feast. After that they came whenever they were invited. But they never stayed long.

"Chirp, chirp! Thank you. Good-bye!" they seemed to say, and they were gone in a flash.

Up in the airy nest they chirped and chattered for a long time. Perhaps they felt sorry for Curly Locks. She had to live in a warm house, poor thing! The winter wind never rocked her to sleep.

Then spring came, just as it does every year, for little boys and girls, and birds and bees and squirrels, if they wait long enough. The nest was crowded, now, for the Fluffy Tail babies were quite grown up. So they tumbled out, like birds, and went hunting for mates. Next they looked for trees with holes in them. Soon they built nests for themselves and set up housekeeping.

Mr. and Mrs. Fluffy Tail stayed in the old home. They had lived together a long time, and were too fond of each other ever to part. By midsummer the

nest was full of new babies. Curly Locks could hardly wait to see them. One day when she was having a tea party for her dollies, under the tree, the whole family raced down and invited themselves to the feast. Mr. and Mrs. Fluffy Tail showed their children just how to behave at a party. They sat up like polite little dogs and begged for food as nicely as anyone could ask.

"And that," said Curly Locks, "was the nicest surprise party I ever had."

STAMP. Have you a United States 30-cent stamp of 1869, or an orange Mauritius penny-stamp of 1847? If so, you may sell the former for perhaps $2,000 and the latter for $3,000. King George V of England once paid $8,000 for a rare stamp. Stamps become very valuable as they grow older and rarer, because so many people collect them. Stamp-collecting, called "philately," has become a widespread and popular pursuit, with associations and periodicals devoted to it.

The common postage stamp, the chief source of postoffice revenue (*see* Postoffice), is the magic power which starts your letter on its journey and enlists the protection and resources of the government in getting it to its destination. Such adhesive stamps were first generally used in England in 1840, at the suggestion of Sir Rowland Hill, as a means of prepaying the postage; and in the United States in 1847. Before that the postage was paid by the person who received the letter, and it varied with the distance, being as much as a shilling between some places in Great Britain. The first English stamp was printed in black and bore a portrait of Queen Victoria. Since then about 1,600 different stamps have been in use in England and her colonies. The first United States postage stamp bore the portrait of Benjamin Franklin.

Tax stamps are also issued as a means of collecting a special revenue. Stamp duties on legal papers and periodicals were first imposed in England in 1694, and it was such a stamp duty that hastened the American Revolution (*see* Stamp Act). Before adhesive stamps were introduced in 1840, the "stamp" was merely an inked impression printed in the margin of the paper, showing the payment of the stamp duty. During the Civil War, the Spanish-American War, and the World War of 1914–18, the United States imposed stamp duties on a great many articles to help meet war costs.

STAMP ACT. The conflict which led to the American Revolution began shortly after the French and Indian War (1754–63). This war doubled the debt of the British government, and at the same time greatly increased the possessions in America which Great Britain had to govern and defend. The British government therefore decided to station British troops in the colonies to prevent the French from recovering Canada, and also to defend the colonies against the Indians. Most Englishmen thought it only right that the colonies should help pay for the support of these troops, since the troops were to provide protection for the colonies. For a partial support of the troops the British Parliament therefore passed the Stamp Tax in 1765. This provided that stamped papers, purchased of the British government, should be used for practically all legal documents, including ships' clearance papers, for all newspapers and pamphlets, and for packages containing playing cards and dice.

This tax aroused great opposition among the colonists, partly because they thought they should enjoy the right of being taxed only by their own representatives, partly because they were opposed to the presence of British troops in the colonies and thought they could defend themselves against the Indians, and partly because the tax, being paid in silver, would carry away so much of their hard money that it would seriously interfere with their commerce and industry. But at first no one thought the act would be forcibly resisted. Benjamin Franklin, who was in England at the time, advised his countrymen to submit to the law until they could get it repealed; and he even recommended two of his friends for the office of stamp commissioners. But a "Stamp Act Congress," in which representatives of nine of the colonies met in New York City on Oct. 7, 1765, declared that only the colonial assemblies could tax the colonists, and so paved the way for resistance.

The Stamp Act could, in fact, very easily be resisted because it could not take effect without the use of the stamped papers; and when these began to arrive, mobs of people often seized the stamps, or forced the ships' captains to take them back to England. They also forced the stamp commissioners to resign their offices, so that even where the stamps were landed there was no one who would distribute them.

Since there were no stamps to be had, what was to be done? The colonists divided into two parties on this question. The higher officials and wealthier merchants were in favor of stopping all business which required the use of stamped papers. "Let the courts close," they said. "Let the ships lie in the harbor. Let the merchants stop importing any British goods. Let the printers stop printing newspapers." This, they said, would be perfectly legal, and it would so seriously interfere with the business of British merchants that Parliament would be forced to repeal the law. But the printers and lawyers, the small shopkeepers and laborers, who would be reduced to distress if business stopped, were in favor of going on with all business just as if no Stamp Act existed. These people called themselves the true "Sons of Liberty," and they charged the more conservative people with being unpatriotic.

Both methods of resisting the law were employed to some extent. The printers went on printing news-

papers. A good deal of trade was carried on without stamped clearance papers. The courts did some business without stamped papers. But the higher courts were closed much of the time; and the merchants formed an agreement not to import British goods, which was pretty well observed. In general there was a marked interference with business, and the poorer classes suffered greatly in the winter of 1766 for want of employment; with the result that rioting and disturbances were common.

This resistance helped to bring about the repeal of the law. Certain men in Great Britain, notably William Pitt, came to the assistance of the Americans. The British merchants, whose trade was seriously cut, pressed for the repeal of the act. In addition there was a change in the ministry, and the new ministers from party reasons were disposed to condemn the action of their opponents. The result of all of these influences was that the Stamp Act was repealed in March 1766. This step, however, was accompanied by a "declaratory act" setting forth Parliament's supreme power over the colonies in matters of taxation, as well as in all other matters of legislation. (*See* Revolution, American.)

STANDISH, MILES (about 1584–1656). When the Pilgrims were living in Leyden they were joined by Miles Standish, an English soldier who had been fighting in the Low Countries. In 1620 he and his wife Rose sailed on the *Mayflower* on its famous voyage to the New World. What led this military man to cast his lot with this little band will never be known; he was not one of their congregation, yet he was destined to be one of their leaders.

The Plymouth colonists soon saw that Standish's army life had been the best possible preparation for the military leadership of the colony and they made him their captain. Into his charge were given all matters of fortification and expeditions against the Indians. When the *Mayflower* cast anchor in Plymouth Bay, we are told, Standish and 16 men, "with every man his musket, sword, and corselet," set out to explore the country along the shore "marching in a single file." Little wonder that the half-dozen Indians who saw this armored procession advancing "ran away with might and main."

No one in the colony understood the Indians as did Standish. When Chief Corbitant kidnapped the colonists' interpreter and friend, Squanto, he promptly marched to the Indian village with a little company of men, rescued the captive, and brought him triumphantly back to the settlement. He knew that what the little body of white men lacked in strength they must supply in quickness and determination. In strange contrast to the bluff man of arms we see in these deeds is Bradford's picture of the Captain during the terrible winter of 1620–21, during which Rose Standish died. He went about from cabin to cabin doing whatever was most needed; cooking, washing clothes, or nursing the sick, with all the tenderness imaginable.

A charming tale of the wooing of Priscilla Mullins is told by Longfellow in 'The Courtship of Miles Standish'. Whether or not this story be true, we do know that Captain Standish later married a young woman who came over in the *Ann.* They and their children lived happily across the bay from Plymouth at Duxbury, a settlement founded by a group of colonists from Plymouth.

STANLEY, SIR HENRY MORTON (1841–1904). "The river was calm, and broad and brown. Armies of parrots screamed overhead as they flew across the river; legions of monkeys sported in the branchy depths; howling baboons alarmed the solitudes; crocodiles haunted the sandy points and islets; herds of hippopotami grunted thunderously at our approach; elephants bathed their sides by the margin of the river; there was unceasing vibration from millions of insects throughout the livelong day; from the shores came the unearthly cry of the relentless cannibals." So wrote the explorer Stanley, of the Congo River in Africa when, the first white man to see these scenes, he descended 2,000 miles of its great extent to its mouth. Far in the interior he had embarked on its waters, without knowing what river it was or where it would lead him. Livingstone, who had discovered the stream near its headwaters, thought it was the Nile because it flowed northward. But Stanley found that presently the river turned westward, and he began to suspect that it might be the Congo, whose mouth on the west coast was already known.

Stanley had entered Africa from the east coast, from Zanzibar, so that when he arrived at the Congo's mouth he had made the complete crossing of this equatorial belt of Africa from east to west, opening up this vast region to the world. The expedition took three years (1874–77), and cost the lives of all three of his white companions, and of many natives.

The results of this expedition were enormous, for it led directly to the formation of the Congo Free State and the exploitation of the region. Stanley himself, after England had refused to interest herself in the new territory, went back to Africa and under the patronage of King Leopold of Belgium, head of the Congo state, took charge of opening the country to commerce, establishing trading posts and river navigation. The great abuses which sprang up later under Leopold's rule were in no way Stanley's fault, as he was throughout the friend of the natives and worked for their good.

Stanley's interest in equatorial Africa had been first aroused some years before, when as a newspaper correspondent he undertook an assignment from the New York *Herald.* "Go find Livingstone," said James Gordon Bennett, the publisher of that paper, to him in Paris. The great missionary explorer David Livingstone had at that time been lost to sight in the interior of Africa for five years. Almost everyone thought him dead. Stanley set out from Zanzibar for the interior on March 21, 1871. After conquering almost insuperable difficulties and trav-

eling for nearly eight months he came to an Arab town named Ujiji on Lake Tanganyika. He had heard rumors from the natives that a white man with a white beard was in this town, and he marched into it between hope and fear. Good fortune was with him, for he found Livingstone, old, ill, and with scanty supplies. When he actually saw before him the great man for whom he had been searching so long, all young Stanley found to say was, "Dr. Livingstone, I presume!"

Stanley stayed in Ujiji four months and became a devoted admirer of Livingstone, but was unable to persuade him to leave his work and return to civilization. After the old missionary's death Stanley determined to continue his work of exploring the interior of Central Africa. The expedition down the Congo was the result.

HENRY M. STANLEY

Stanley's life throughout was a curiously adventurous one. His name was originally John Rowlands and he was born in Wales. After a youth of extreme poverty, he ran away to sea and landed in New Orleans, where he was adopted by a merchant named Stanley, whose name he took. He fought with the Confederate army in the Civil War, was for a time in the United States navy, and later became a newspaper correspondent. In this capacity he traveled in Asia Minor, and accompanied an expedition under General Hancock against the Indians in the West, a British expedition against the emperor of Abyssinia, and still a third, also British, to Ashanti on Africa's west coast.

After Stanley had established navigation on the Congo he made still another expedition across that continent. This time he traveled from west to east, ascending the Congo and cutting across the vast tropical forest to Lake Albert Nyanza. The object of this expedition was to rescue Emin Pasha, a German agent of the Egyptian government who was cut off in equatorial Africa by a native uprising. With Emin, Stanley arrived at Zanzibar, the point of departure for his earlier expeditions, in December 1889.

This expedition ended Stanley's active career in Africa. His later years were spent in England, where he again became a British subject, was elected to Parliament, and was made a knight. No man did more to open up the interior of Africa to knowledge and civilization, and few have had a more romantic or adventurous career than this poor orphan boy who was honored at his death with a public funeral in Westminster Abbey.

Stanley's writings include: 'How I Found Livingstone' (1872); 'Through the Dark Continent' (1878); 'In Darkest Africa' (1890); 'My Dark Companions and Their Strange Stories' (1893); 'My Early Travels and Adventures in America and Asia' (1895); 'Through South Africa' (1898); 'Autobiography' (edited by his wife, 1909).

STANTON, EDWIN MCMASTERS (1814–1869). The task of administering the War Department of the American government through the Civil War fell to Edwin M. Stanton; to him was given the handling of thousands of men and millions of dollars at a time when the very existence of the country depended on men and money.

The man who bore this great responsibility began life as a lawyer in Ohio and an anti-slavery Democrat. He had attended Kenyon College, in Ohio, and then studied law, being admitted to the bar in 1836. For a time he practiced law, first in Steubenville, Ohio, and then at Pittsburgh, Pa. While still practicing in Ohio he met Lincoln as an associate in one of his cases, and disdainfully inquired, "Where did that long-armed creature come from, and what can he expect to do in this case?" As Stanton's practice before the United States Supreme Court increased he moved to Washington, in 1856. In 1860 he was appointed attorney-general by President Buchanan. He was violently opposed to Lincoln in 1860, and referred to him as the "original gorilla." He retired from office at the end of Buchanan's term.

In spite of his opposition to Lincoln and to the Republican party, and in spite of his remarks concerning the "painful imbecility of Lincoln," the new President offered him the place of secretary of war in 1862. He accepted the position, as he honestly said, "to help save the country."

Stanton was of a tactless disposition, and hard to coöperate with. But Lincoln managed to "plow around him," though at times the President found it "necessary to put his foot down firmly," as when he insisted that the proportion of troops to be furnished by New York in 1864 was too high, and that Stanton should reduce the quota by 9,000.

In spite of frequent differences of opinion Lincoln recognized Stanton's ability. When pressure was exerted to induce him to remove the unpopular secretary from office, he replied, "If you will find another secretary of war like him, I will gladly appoint him." In the meantime Stanton's estimate of Lincoln had undergone a radical change. At Lincoln's death Stanton said, "There lies the most perfect ruler of men the world has ever seen."

After Lincoln's assassination Stanton continued to hold his position under President Johnson, until 1868. His relations with Johnson were never pleasant, and finally the President sought to remove him from office. This attempt led to the impeachment of the President (*see* Johnson, Andrew). When the proceedings against Johnson failed, Stanton resigned and returned to the practice of law.

contained in the Easy Reference Fact-Index at the end of this work

The next year he was appointed by President Grant to the United States Supreme Court, but he died four days after the appointment was made. Though the country recognized Stanton as an able administrator, he was generally disliked for his overbearing manner and his sharp tongue, which on more than one occasion changed a friend into an enemy. As time goes on and his abrupt ways are forgotten, the value of the services which he rendered in those troubled years is more and more clearly understood.

STAR. There are reasons for believing that the total number of stars is just about sufficient to provide one of these celestial luminaries for each inhabitant of the earth. But if each of us should receive his particular star there would be millions of persons who would have to be satisfied with stars that are not visible to the unaided eye, and which we can only detect with the most powerful instruments.

Actually less than 2,500 stars can be seen by the observer in the Northern Hemisphere looking up at the heavens on the clearest night, without the aid of a telescope. And not every one of these is certain to be a "star" in the strict sense of the word. At least four or five may be "planets," which are quite different from the great majority of the heavenly objects (*see* Planets). The myriads of stars, that suggest little lamps hung in the canopy of heaven, are in reality great balls of fire like our sun; and it is only because of their immense distance from the earth that they do not overwhelm us with a blaze of heat and light. Our own sun would, in fact, pale into insignificance if seen at equal distances with some of the giant luminaries of the limitless sky.

With modern high power telescopes it is possible to see and photograph at least one hundred million of those celestial fires that we call stars. There are so many that no actual count has ever been made, and even those that can be seen in the telescopes do not exhaust the extent of the starry universe. For some years astronomers have been systematically photographing the heavens through their telescopes, bit by bit, and the camera is able to record on those photographic plates stars so faint as to be undetected by the human eye, even with the aid of the most powerful telescope. It is calculated that those plates will show about a thousand million (one billion) fixed stars, and that altogether there are as many as 1,800,000,000 shining stars, or about as many as there are people now in the world.

The Dead Worlds in the Fields of Space

In addition to these stars that shine, there are great hosts of "dark" or "dead" stars, some of which betray their presence by their effect on their luminous companions. Perhaps some of these dark stars are really planets revolving in solar systems similar to that of which the earth is a part. We cannot see those bodies, nor do they show in the photographs, but we can detect them in some instances by their periodical dimming effect on bright stars about which they revolve, thus producing a "variable" star. If this is true (and there is much evidence for this view), then somewhere in the universe there may exist worlds like our own—worlds where plants and animals and thinking beings grow and develop much as they do on the earth—though of course they would not necessarily be human beings.

Even if the beings on these supposed worlds should develop wireless systems capable of traveling across interstellar space, it would take years and in some cases centuries for their messages to travel to us, in spite of the fact that radio waves travel at the same speed as light, 186,000 miles a second. It takes over *four years* (4.4 years, to be exact) for light to reach us from the nearest known star, which is Alpha Cen-

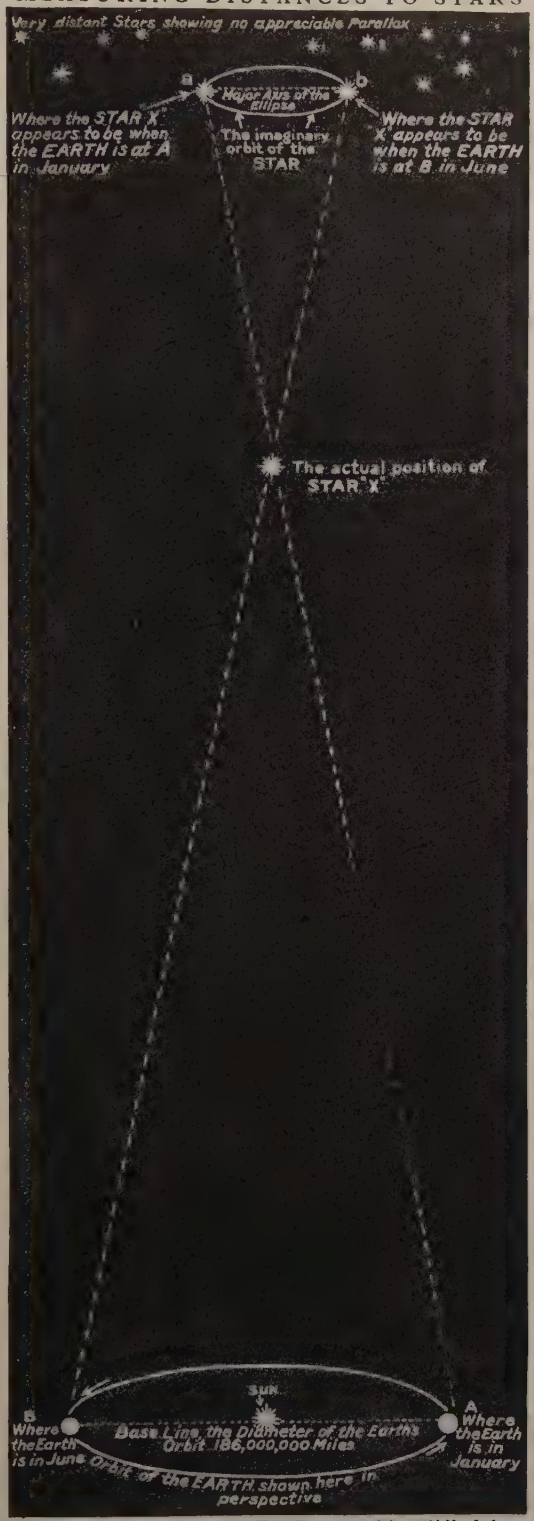
tauri (not visible in northern latitudes); while the rays of light that are now coming to us from some of the more distant stars undoubtedly started on their journey before the birth of Christ!

At the present moment some great catastrophe, such as those which cause "new stars" from time to time to blaze forth, may be happening somewhere in the universe, yet the light of it will not be visible on earth till the time of our great-great-grandchildren, or of descendants even more remote.

If a man could reach up and touch the sun, it has been figured that, considering the rate at which nerve sensation travels, he would not know his hand had been burned for 100 years. But if he could touch the nearest fixed star, he would not realize that he had burned his hand unless he should live to be 27,500,000 years old!

How is it possible for men to measure these enormous distances that separate us from the stars? It is done by determining what is called the "annual parallax" of the star. This process consists in observing the star from one position in the earth's orbit and then six months later from another one, and computing the breadth of the resulting angle. The distances are so great that the angle is very slight, and the measurements must be so delicate that the parallax of only a comparatively few stars has been determined with approximate accuracy. The nearer the star, however, the easier it is to measure this angle, so we know that the many stars which are still unmeasured lie a greater distance than those for which the parallax has been measured. The first parallax determination was made by Bessel in 1838, and is regarded as one of the greatest achievements of science.

MEASURING DISTANCES TO STARS


Very distant Stars showing no appreciable Parallax
a
b
Major Axis of the Ellipse
Where the STAR X appears to be when the EARTH is at A in January
The imaginary orbit of the STAR
Where the STAR X appears to be when the EARTH is at B in June
The actual position of STAR X
Sun
B
Where the Earth is in June
Base Line, the Diameter of the Earths Orbit 186,000,000 Miles
A
Where the Earth is in January
Orbit of the EARTH shown here in perspective

Suppose that an astronomer wants to learn the distance to star "X." From position "A" of the earth he measures the angle between "X" and several exceedingly distant stars, such as "1" and "2." When the earth is at "B," he repeats the measurements. From his knowledge that the changes he detects in the angles are caused by a displacement of 186,000,000 miles in the earth's position, he computes the distance to "X."

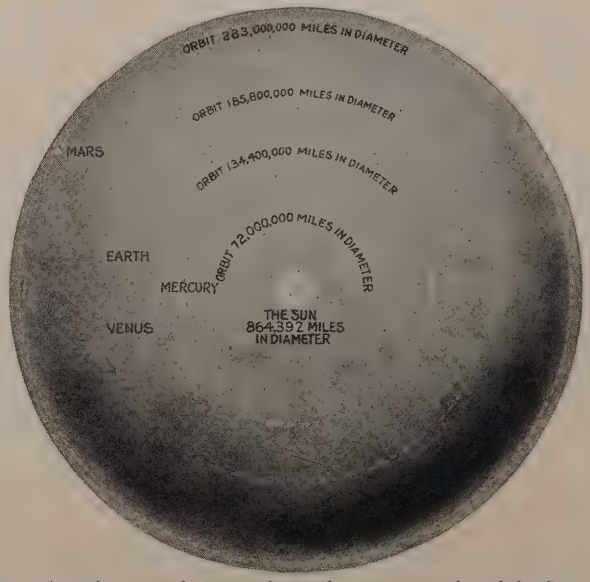
Our universe, as astronomers conceive it, is a great sphere so far across that it can only be expressed in figures that stagger the imagination, without conveying any true impression of its immensity. In the central portion of this sphere lies the Milky Way, or Galaxy, a great concourse of stars and nebulae which has been compared to a huge grindstone, with various rifts and breaks (*see* Nebulae). Most of the stars cluster in and about this huge ring or band, growing thinner toward the Poles. The Earth and solar system seem to occupy a position somewhere near the center of the grindstone, yet the movement of the stars is such that some day we may be carried to the outer edge.

If we look at the stars at a particular time at night, and then view them an hour or so later, we see that they have changed their apparent positions in the heavens—that is, with the single exception of the Pole Star. But this change is due solely to the rotation of the Earth on its axis. From a railroad train it often seems as if the telegraph poles were in motion, and the man who observes the stars gets a similar impression regarding heavenly objects. Even the ancients realized that at any particular hour on any particular night of the year—at 12 o'clock midnight on January 1, for example—the stars always present the same picture, and for that

reason they called them "fixed stars" as opposed to the planets, which they named the "wanderers."

But the stars are not really fixed, any more than the Earth and the Sun and the Moon are fixed. They are moving among themselves with enormous velocity, and so far as we now know, almost in straight lines. Our Sun, which itself is a star, is moving with the whole solar system in the direction of the first magnitude star Vega at the rate of 760 miles a minute; but even at this terrific speed it will take us more than half a million years to arrive, even if nothing interferes to change our direction or retard our motion. Some of the other stars move so fast that it seems certain that they will some day escape from our universe altogether, going out into space or nothingness, or perhaps toward other universes of which we have not the faintest inkling or conception. These "runaway stars," as they are called, have in some cases a velocity as high as 200 miles a second; and one of these "speed demons" of the sky could go completely around the earth in a little more than two minutes.

A STAR THAT MAKES OUR SUN A PIGMY



You have been taught to wonder at the enormous size of the Sun. Now try to imagine a star so large that the Sun would be a speck at its center, while the four planets—Mercury, Venus, the Earth, and Mars—could revolve around the Sun, and still be inside the body of the star! Such is the gigantic and unbelievable size of Betelguese, the first of the stars to be measured by the method described on page 3344. The star, with its diameter of about 300,000,000 miles, is represented in this drawing by the whole shaded circle. Yet, for all we know, there are other stars beside which Betelguese itself would be a speck.

Stars are ordinarily classified by "magnitudes," in the order of their brightness. In the "first magnitude" are placed the 20 brightest stars—Sirius, *Canopus, *Alpha Centauri, Vega, Capella, Arcturus, Rigel, Procyon, Achernar, *Beta Centauri, Betelguese, Altair, *Alpha Crucis, Aldebaran, Pollux, Spica, Antares, Fomalhaut, Deneb, and Regulus. (Those marked with an asterisk (*) cannot be seen in northern latitudes.) In the second group are 65 stars, including the Pole Star and the two Pointers. In the third group we have 190; in the fourth, 425; in the fifth, 1,100; in the sixth, 3,200; and so on until in the magnitudes between the 16th and 17th, there are supposed to be more than 25,000,000 stars, none of which, of course, can be seen without the most powerful telescopes. The stars seem to twinkle because of the effect produced on the light waves by the Earth's own atmosphere. The human eye unaided by a telescope cannot see stars of less than the sixth magnitude.

The natural groups or constellations which the stars seem to form in the sky have been given various fanciful or legendary names—for example: Ursa Major (the Great Bear), Lyra (the Harp), Taurus (the Bull), and Orion (the Warrior) (*see* Constellations). In our system of cataloging it is usual to designate the stars in each constellation by Greek letters in the order of their brilliance. Thus the pointer star nearest Polaris is named, according to this system, Alpha Ursa Majoris (brightest star of the Great Bear).

Let us consider for a moment some of the brightest stars. Most important to navigators and explorers is Polaris (the Pole Star), which, though it appears to us as a somewhat dim star of the second magnitude, is disclosed through great telescopes as a triple sun—really three stars instead of one, but so far away that they cannot be distinguished by the naked eye.

The most brilliant of all the stars is Sirius, the "Dog Star," best observed about the first of March. This great sun, which is more than three times as large as our own, has had an interesting career in the annals of astronomy. The discoverer of Halley's comet was the first to suspect that Sirius was not behaving exactly as he should, but it remained for F. W. Bessel in 1844 to work out the facts, though they could not then be demonstrated for lack of powerful enough instruments. He declared that Sirius had an unseen companion star, about half as large; that the two revolved about the same center of gravity; and that they were approaching the solar system at the rate of about 360 miles a minute. An American, Alvan G. Clark, found this companion star with a new telescope he had constructed, and thus Bessel's computations were verified beyond the shadow of a doubt.

Sirius is comparatively near to us, being the third in distance from the sun. But just to give some idea what "near" in this connection means, let us set down the figures. Sirius, then, is 47,000,000,000-000—47 trillion—miles from our Earth! We needn't worry much about a collision, even if Sirius is headed in our direction at a velocity about six times as fast as the fastest projectile that ever left the muzzle of a great gun, for even at that rate it would not arrive in much less than a quarter of a million years.

For any subject not found in its alphabetical place see information

It happens that the companion of Sirius does not interfere with the light it sends to the earth; but in the case of Algol, which also has a companion star, a regular eclipse occurs. Algol means "Demon," and it was so called by the Arabs because it shines with the brightness of the Pole Star for about two and a half days, when suddenly its light is reduced by two-thirds; then in a few hours it regains its former intensity. This peculiar behavior, it has been discovered, is due to Algol's dark companion which, in circling about, gets between the star and the Earth and shuts off part of the light which we receive from it.

Over 50 eclipsing "variables" of the Algol type are known and it is estimated that one star in every four has a partner or companion star. More than 13,000 such stars have been observed and counted.

Vega is not only interesting because the solar system is traveling towards it, but because in about 12,000 years it will become the north star instead of Polaris. This is due to what is called the "precession of the equinoxes," which causes the true north-and-south axis of the Earth to move about in a circle with respect to the stars, like the upper part of a spinning top.

Shall We Ever Bump into a Star?

Is there a chance that some star may one day collide with the Sun or the Earth? Such a collision is possible but very unlikely. Yet at various times so-called temporary or "new stars" (*novae*) have blazed out in the heavens, suggesting that two relatively dark bodies have crashed together in a great celestial collision that would make the eruption of Vesuvius or Katmai seem like the pop of a penny firecracker. The fact that these *novae* are rarely visible for more than a few months bears out the theory that a collision has occurred; that heat and light have been developed in enormous quantities, and that finally the combined bodies sink back into darkness, perhaps with their particles scattered far and wide through interstellar space.

One of the most spectacular of the *novae* burst into brilliance during the summer of 1919, and for some days shone in the constellation Aquila as bright as the stars of the first magnitude, actually rivaling Sirius. After a few weeks, however, it had sunk to the sixth magnitude, and soon became invisible to the naked eye. The *novae*, of course, should not be confused with "shooting stars," which are meteors (*see* Meteors and Meteorites).

When we observe the colors of the stars—usually blue, white, yellow, or red—we would hardly suppose that by means of the spectroscope those rays of light could be made to yield not only the secret of the composition of the stars, but also the speed with which they are moving toward or away from us. Yet this is the fact, and the spectroscope in the hands of astronomers is fully as important as the telescope. Through it we have learned, for example, that many of the stars contain helium, hydrogen, and carbon, as well as various metallic combinations such as are

THE "MILK" IN THE MILKY WAY

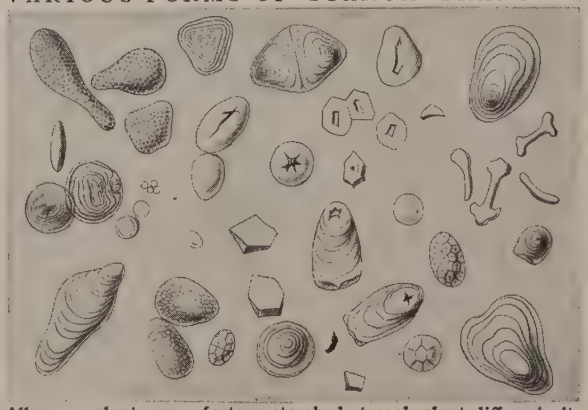
That long irregular belt of white across the sky, called the Milky Way, or Galaxy, is really made up of myriads of stars which are so far away they look like a misty band. Stars are grouped more thickly in this Milky Way than anywhere else in the heavens.

found on this Earth. But the spectroscope also reveals the presence of many substances of which we have no other knowledge whatever (*see* Spectrum and Spectroscope).

One of the greatest recent achievements of astronomy has been the invention of a method for determining the diameter of stars, by Professor Michelson of Chicago. The stars are so far away that they appear as points in the telescope, no matter whether large or small, and so cannot be measured by any previously known method. Professor Michelson found, however, that if a plate containing two parallel slits be placed over the objective of the telescope, the image of a star viewed through the slits would be crossed by bars of light and darkness, because of "interference" (*see* Light). Then as the slits are moved apart, the bars disappear. The amount of separation required to cause this disappearance depends upon the distance and diameter of the star. Using this method, members of the Mt. Wilson observatory staff found the diameter of Betelguese, the brightest star in the constellation Orion, to be about 300,000,000 miles—great enough so that if its center were placed at the center of the Sun, its outer edge would lie outside the orbit of Mars, thus engulfing nearly half of the whole solar system!

When one thinks of how long men have studied the stars, and yet how great are the marvels revealed in the past hundred years, there seems almost no limit to the hopes we may have of yet further knowledge of these mysterious, far-off, awe-inspiring worlds of the heavenly firmament.

VARIOUS FORMS OF STARCH GRANULES



All green plants manufacture starch, but each plant differs in its ideas of what its granules should look like and what size they should be. Under the microscope they are seen to consist of a nucleus surrounded by layers. In several of the granules in this group the layers may be plainly seen.

STARCH. Stored up in most plants, especially in the seeds, bulbs, tubers, etc., is a substance called starch ($C_6H_{10}O_5$), which is one of the most important elements of plant life. It has the same elements as sugar—carbon, hydrogen, and oxygen—but in different proportions. It occurs as small grains or granules, which differ in shape in each species of plant. Starch is found especially in cereals, potatoes, carrots, parsnips, sago, tapioca, and rice. Potatoes are about one-fifth starch; rye, oats, wheat, and corn, nearly two-thirds; and rice about nine-tenths.

For commercial purposes starch is usually obtained from potatoes, corn, wheat, rice, or other grain. From corn it is made by soaking 48 hours in water, then grinding and straining through sieves, after which the starch is allowed to settle in vats, when it is washed, bleached, and dried. Potato starch is made by grating potatoes, adding water, and straining, settling, washing, and drying. Wheat starch and rice starch are made by slightly different processes, to remove the gluten they contain.

As usually prepared, starch is either a white powder or irregular white lumps, which come from the breaking up of a dried cake of the material. It does not dissolve but is merely suspended in cold water, but in hot water the granules burst, forming a clear paste, which is the starch used in the laundry. When heated to about 360° Fahrenheit, it is changed into dextrine, the gum used on postage stamps.

Cornstarch was first made in the United States in 1842, the factory at Oswego, N. Y., early becoming famous as one of the largest starch factories in the world. Argo, Ill., a suburb of Chicago, now leads the world in this important manufacture.

STAR CHAMBER. This term was first applied to an English court which met in the council chamber of the palace at Westminster. The roof of the room was decorated with gilt stars, which are supposed to have given the court its name. The court was founded or restored in 1487 by Henry VII, to assist in bringing to justice the great land-owners and nobles. It was independent of a jury, who were too often afraid of the nobility, and it could inflict any punishment but death. The trial was conducted by written questions, unless the accused chose to confess. Torture came to be used to extort confessions, and in the reign of Charles I such an outcry was raised against the abuse of its power that the court was abolished in 1641.

STARFISH AND SEA-URCHINS. The "sea-star" that one sees through shallow water near an ocean beach, lying flat on the sand or clinging to some barnacle-dotted rock, is a queer creature. One or another sort is to be found in all parts of the world except the polar regions; and the common one of the North Atlantic is altogether too common on the oyster-beds, for it crawls there in thousands, and destroys perhaps $100,000 worth of oysters every year in Long Island Sound alone.

A well grown starfish has the shape of a regular five-pointed star, about six inches across and an inch thick in the center. It is brown in color and covered with a mosaic of limy plates and rows of points, and near the center is a small sievelike opening. This is its dorsal (back) surface. Turn it over. The lower or ventral side shows a "furrow," broadening from

the tip of each of the five "arms" toward the center, where a circular opening (the mouth) is closed at the moment by five pointed teeth meeting at the center. That mouth opens into a loose bag of a stomach, whose folds extend out into the arms; and around it is a circular system of water-tubes, blood-vessels, egg-producing organs, and so forth.

Now put your starfish (which is not a fish at all) into an aquarium. When he crawls up its glass wall, showing his under side, you see, pushed out from rows of tiny holes in the furrow, slender glassy tubes ending in a sucker by which the animal clings to the glass. They are swollen with water sucked in through the sieve in his back, and it is by these clinging "feet" that the starfish pulls himself slowly over the sea-floor.

A STARFISH'S WAY WITH AN OYSTER

The starfish attaches itself to the shell and pulls. The oyster resists until worn out, then yields and is eaten.

Starfish are of many kinds and varied shapes. Some are very thick, with short fat arms; others are small and flat, with snaky arms (brittle stars); others have the arms many-branched (basket-fish), and so on. If a starfish loses an "arm" it promptly grows another; and if it is cut into halves, each piece grows into a new individual.

Starfish are one of the three divisions of a class of marine animals called *Echinoderms*, that is, "spiny-skinned" animals. All have their internal organs—and to some extent their outer form—arranged in five parts around a central stomach. The other two divisions are the sea-urchins and the sea-cucumbers.

The latter are highly prized as food in the Orient, being known as "trepang" (*see* Sea-Cucumber).

The sea-urchins are as various in shape as the starfish. Some, like the sand-dollars, are as flat as a thin cookie, and when you rub off the velvet-like skin you find on the lower side a five-pointed pattern of holes for tube-feet, precisely as in a starfish. Another kind has the shape and bigness of a bun; and here, again, under the spiny coat of its flat lower side, you can see the five furrows. In the spherical or egg-shaped sea-urchins, these furrows extend up the sides, and the tube-feet are longer than in starfishes. By means of these and its spines, the animal can move along at about as slow a rate of travel as one can imagine. But these are not restless folk, and most of them sit calmly where they find themselves, hoping to be overlooked in their dull green or purplish coat by the big fishes, turtles, and other enemies who consider their soft insides good eating. Their bristling spines which protect them against small fishes, crabs, worms, etc., make small sea-urchins resemble a chestnut-bur; while the large ones are really formidable to anything less than a ground-shark. In among the spines, which are mounted on a sort of hinge and may be waved about, are scattered many queer flexible appendages ending in a sort of finger and thumb. With these the urchin (which is derived from the French word for "hedgehog") picks off and throws away particles of drift and dirt that get entangled in his rough overcoat. All sit or move about face down and get their living by scooping up mud, out of which the stomach extracts nourishment from the minute life it contains, or by nibbling edible things which adhere to rocks and weeds.

LITTLE HEDGEHOGS OF THE SEA

Why a creature that looks like this should be called an "urchin" seems odd until we know that "urchin" in this connection is a contraction from "hérisson," a French word meaning "hedgehog." That is plain enough, isn't it? On the left you see the Sea-urchin with his prickly overcoat removed.

Starfishes and sea-urchins mature every summer great numbers of minute eggs that are poured out into the water. Most of these eggs soon disappear down the throats of sea-anemones and other hungry creatures. But from a few are hatched strange little young (*larvae*) that drift about until (in most cases) they are eaten by some creature. Now and then one escapes and settles down in some safe spot on the bottom, where it is left to grow into an adult of its kind.

STARLING. The starling is a bird foreigner whose value as an American citizen birdlovers seriously question. When this singing blackbird was introduced from England into New Zealand, it became a very destructive pest. Since their importation into the United States in 1890, when 60 specimens were liberated in Central Park, New York, the increase

and spread have been rapid. Besides their tendency to destroy fruit, their pugnacious disposition leads them to drive out other songbirds, as well as sparrows and flickers. They have even been known to conquer a male sparrow hawk.

The starling is about eight inches long, and has beautiful black plumage, brightly shot with purple, green, and steel blue; most of the feathers are tipped with buff. (For illustration in colors, *see* Birds.)

In Europe, especially in Great Britain, the starling *Sturnus vulgaris* is a great favorite. It is very active and interesting, with a most sociable disposition, nesting among buildings and becoming quite tame. Out of fruit season, when its food is largely insects, farmers consider it a valuable addition to their bird population, but a large flock of hungry starlings is not welcome in field or orchard.

STATE GOVERNMENTS. While the men of 1776 were writing their Declaration of Independence from England, they had also to turn their attention to forming governments for the separate colonies, or "states" as they were called after the Declaration was issued. This political division, next below the Federal government in size and importance, thus goes back to the very beginning of American national history; and rival schools of historians have disputed whether the states preceded the Union or the Union the states. At first there were only 13 such commonwealths. Today there are 48, for 35 have been admitted by Congress; but all, both old and new, are alike in the main features of their governments.

In the first place the United States Constitution puts certain limits upon all. It guarantees to the citizens of all the states a republican form of government. Each must extend the same privileges to citizens of other states that it gives to its own. It must also return fugitives from justice who are charged with treason, felony, or other crime; this is called "extradition." Likewise the state cannot exercise any power which is conferred upon the national government alone, such as levying import duties, coining money, etc.

The Constitutions of the States

Every state has a written constitution, for Congress will not admit a new state to the Union until it has formed an acceptable constitution. Some of these documents are long, some comparatively short, but all contain certain features. In practically every one there is a Bill of Rights listing rights which the state may not take away from the individual. In all there are provisions for the organization of the legislative, executive, and judicial departments, and defining the powers and duties of each. And finally there are provisions for amendments and revision, for state constitutions are frequently changed, the average life being from 20 to 30 years.

In 23 states the legislative body is known as the "Legislature," in 20 as the "General Assembly," in 3 as the "Legislative Assembly," and in New Hampshire and Massachusetts as the "General Court." Each legislative body is composed of two houses, though Pennsylvania and Vermont at one time had legislatures of a single house each. The membership in the upper house varies from 16 in Nevada to 67 in Minnesota; that of the lower house from 35 in Arizona and in Delaware to 405 in New Hampshire.

The legislatures of six states meet every year, that of Alabama meets only every four years, and those of the others every two years. At these meetings the legislatures may pass upon any subjects "not delegated to the United States by the Constitution, nor prohibited by it to the states." For example, they can legislate concerning taxation, inheritances, mortgages, corporations, marriage and divorce, crime, public health, education, and business or professional regulations. From this list of subjects you can see that the state is the most important division of government so far as the individual is concerned.

Duties of the Governor

To carry out these laws each state has a governor elected by the people. His term varies from one year in Massachusetts to five in New Mexico, most having either a two- or four-year term. All of the states except North Carolina give the governor the right to veto laws passed by the legislature, but in some states this is only a "suspensive veto," and can be overridden by a mere majority vote. He may also call extra sessions, recommend laws to be passed, and pardon criminals. He is charged with the duty of enforcing the laws of the commonwealth, but as the officers through whom he executes this duty are in large part elected by the people and are not responsible to him, this provision amounts to little except in cases of extraordinary emergency.

Each state also has a system of courts to try those who are accused of violating its laws (*see* Courts of Justice). There are always a number of other officials, such as the superintendent of public instruction, the board of medical examiners, auditor, state treasurer, attorney-general, etc.

The word "state" is also used in a more general sense to indicate any sovereign government; thus Great Britain, France, Germany, Russia, are "states" in this wider sense. The term "country" is purely geographic, and may be applied to a district that has no separate government.

The term "nation" refers to the *people* primarily, and not specially to the government. But not every "people" constitutes a "nation"; the essence of nationality is the desire and will on the part of a people to constitute a state—common memories of the past, common interests in the present, common hopes for the future. Possession of the same blood, language, and religion and residence in a well defined geographical unit or country are principal factors in producing a sentiment of nationality; but none of these is indispensable. Thus the Swiss, in spite of the fact that different cantons speak German, French, and Italian, that some are Catholic and others Prot-

HOW THE STATES GOT THEIR NAMES—THEIR NICKNAMES AND SYMBOLS

NAME	PROBABLE ORIGIN AND MEANING	POPULAR NAME	FLOWER OR SYMBOL
Alabama	From Creek Indian word meaning "place of rest," or from name of Alibamu Indians	Cotton State	Goldenrod Giant cactus
Arizona	Indian word meaning "place of small springs"	Bear State	Apple blossom
Arkansas	Name of Indian tribe, meaning unknown		
California	From name of a fabled island in Spanish romance, or from *caliento forno* ("hot furnace"), first applied to Lower California	Golden State	Golden poppy
Colorado	Spanish word meaning "reddish colored," first given to the river	Centennial State	Columbine
Connecticut	From Connecticut River, originally called by the Indians "Quonoktacut"	Nutmeg State	Mountain laurel
Delaware	From Lord de la Warr, first governor of Virginia	Blue Hen State	Peach blossom
Florida	From *Pascua florida*, Spanish for "Easter Sunday" (Flowery Feast)	Everglade State	Orange blossom
Georgia	In honor of King George II of England	Cracker State or Empire State of the South	Cherokee rose Syringa
Idaho	Indian word meaning "gem of the mountains"	Prairie or Sucker State	Violet [blossom
Illinois	Indian tribe, Illini ("men"), with French ending	Hoosier State	Tulip tree
Indiana	Formed by adding "a" to "Indian" ("land of Indians")	Hawkeye State	Wild rose
Iowa	Indian name meaning "sleepy waters," first applied to Iowa River	Jayhawker or Sunflower State	Sunflower
Kansas	From Indian tribe, kanzas, meaning "wind people"		
Kentucky	Probably from "Kentake," Indian name meaning "meadow land" or "prairie"	Blue Grass State	Trumpet vine
Louisiana	"Land of Louis," in honor of King Louis XIV of France	Pelican State	Magnolia
Maine	Perhaps from name of province in France; styled "Province of Maine" in charter of 1622	Pine Tree State	Pine cone
Maryland	In honor of Queen Henrietta Maria of England	Old Line State	Black-eyed Susan
Massachusetts	Name of tribe of Indians, originally given to bay, meaning "place of great hills"	Old Bay State	
Michigan	From Indian word meaning "great lake" or "great water"	Wolverine State	Apple blossom
Minnesota	Indian name meaning "clouded water"	Gopher State	Moccasin
Mississippi	From Indian word meaning "gathering of all the waters" or "great river"	Bayou State	Magnolia
Missouri	Indian word meaning "big muddy stream"	Bullion State	Goldenrod
Montana	Spanish for "mountain"	Treasure State	Bitter root
Nebraska	Sioux Indian name meaning "shallow water"	Tree-Planter State	Goldenrod
Nevada	Spanish for "snowy"	Sagebrush or Silver State	Sagebrush
New Hampshire	From the county of "Hants" or "Hampshire" in England	Granite State	
New Jersey	From island of Jersey in the English Channel	Garden State	Sugar maple (tree)
New Mexico	From Indian name Mexitl, an Aztec divinity		Cactus
New York	In honor of the Duke of York, afterward James II of England	Empire State	Rose
North Carolina	"Land of Charles," in honor of Charles II of England	Old North State or Tar Heel State	Daisy
North Dakota	Indian name of confederate Sioux tribes, meaning "allies"	Flickertail State	Wild prairie rose
Ohio	Indian name meaning "beautiful river"	Buckeye State	Carnation Mistletoe
Oklahoma	Choctaw Indian name meaning "red people"		
Oregon	From name at first given to Columbia River and popularized in Bryant's 'Thanatopsis'	Beaver State	Oregon grape
Pennsylvania	Latin form for "Penn's woods" in honor of its founder, William Penn	Keystone State	
Rhode Island	From Dutch *Roode Eylandt*, meaning "red island"	Little Rhody	Violet
South Carolina	*See* North Carolina	Palmetto State	
South Dakota	*See* North Dakota	Sunshine State	Pasque flower
Tennessee	Indian name for Tennessee River; meaning unknown	Big Bend State	
Texas	Named from Texas tribe of Indians	Lone Star State	Bluebonnet
Utah	From Ute tribe of Indians	Salt Lake State	Sego lily
Vermont	French name meaning "green mountains"	Green Mountain State	Red clover
Virginia	From the "Virgin Queen" Elizabeth of England	The Old Dominion	
Washington	In honor of George Washington	Evergreen State	Rhododendron
West Virginia	*See* Virginia	The Panhandle State	Rhododendron
Wisconsin	Indian name of uncertain meaning; perhaps "wild rushing river" or "meeting place of the rivers"	Badger State	Violet
Wyoming	From Wyoming valley in Pennsylvania (scene of Indian massacre in 1778)	Equality State	Indian paint-brush

estant, and that there is considerable difference of blood (race), undoubtedly now constitute a nation. On the other hand, it was doubtful until after the Civil War whether the United States was or was not a nation.

STATES' RIGHTS. When the 13 American colonies in 1776 separated themselves from England, according to one view each one stood as an independent nation, though they knew that they must ultimately be united. If they stayed divided they would be reconquered by England or taken by some other nation. Accordingly in the Articles of Confederation (1779) they formed a Federal government to which each state gave some of its rights. But they gave so few that the government under the Articles proved too weak to accomplish anything, and so in 1787 a new Constitution and Federal government were formed to meet the problem.

Under this new Constitution, each state now gave up many more of its rights to the central government. But still many people claimed that the people of a state owed their first duty to that state; that if a state law conflicted with a Federal law, the state law should be obeyed; and finally, that if a state did not approve of a Federal law it might declare that the law should not be enforced in the state— in other words, might "nullify" it. This idea was known as the "Doctrine of Nullification and States' Rights," and its aim was to prevent the federal government from acquiring sovereign power.

The first appearance of this doctrine was in 1798, when the legislatures of Kentucky and Virginia protested against the Alien and Sedition laws (passed by the Federalists), which permitted the president of the United States to remove from the country aliens or foreigners whose presence was considered dangerous, and to punish anyone who by speech or writing stirred up sedition or rebellion in the United States. During the War of 1812, Federalist New England, which was opposed to the conflict, refused to obey President Madison's call for troops and even threatened to withdraw from the Union.

Later the idea became part of the creed of the Southern states and of their leaders. Their "peculiar institution" (slavery) was constantly threatened by Federal legislation, and their lack of manufactures made them equally hostile to tariffs and other Federal legislation urged by the more industrial North, with its free labor. "States' Rights" was the South's first line of defence against this increasing tendency to national government.

In South Carolina, in 1832, it was declared that the high tariff law was "null and void" and that its citizens need not obey it. President Jackson's firm attitude—as announced in his toast "The Federal Government, it must be preserved"—and the passage of a more moderate tariff law settled the trouble for that time. It was then that Webster in his orations gave classic form to the idea of "the Union, one and inseparable."

In 1860–61 the Southern states attempted to carry out their oft-repeated threat of secession. They claimed that, as they had voluntarily joined the Union, so they could leave it at pleasure. The North, on the other hand, claimed that no state had a right to leave the Union of its own will. The Civil War followed, and the North by force of arms compelled the South to accept their belief.

Since the Civil War no one has thought that a state could secede from the Union or nullify a national law. "States' Rights" in that sense is dead. But some still hold that as many rights as possible should be left to the states, and that in case of doubt as to whether a right has been granted to the Federal government or retained by the states, it should be given to the state. This belief is steadily losing ground today, and the central government is using more and more of the rights formerly exercised by states.

The MACHINE *that Puts* STEAM TO WORK

The Story of the Steam Engine from Hero of Alexandria to James Watt and Our Own Day—How a Lazy but Ingenious Lad Helped Develop It—What "Horse-Power" Means

STEAM ENGINE. The steam engine is a device for converting the heat energy of steam into mechanical work, and thus belongs to the class of devices called heat engines. Other forms of heat engine are the gas engine and the hot air engine, devices for turning the heat of exploding gas mixtures, or of expanding hot air, into mechanical work. The first attempted use of steam to do work dates back to the 2d century B.C., when Hero of Alexandria devised several forms of steam apparatus—apparently only toys, if indeed, they were really built.

The beginning of the modern steam engine was in the water-raising engine of Thomas Savery in 1698. In this the steam acted directly on the water to be raised. The first use of the piston was by Papin in 1705 in a modification of Savery's engine. In the same year Thomas Newcomen made a piston engine which more nearly approached our modern form. It was, as its name implied, an atmospheric engine. The piston working in a cylinder was connected by a chain with one end of an overhead beam. Steam admitted from the boiler to the cylinder allowed the piston to be raised by a heavy counterpoise hung from the other end of the beam. Then the valve was shut and the steam in the cylinder condensed by a jet of cold water. This left a vacuum in the cylinder and the piston was forced down by the pressure of the atmosphere, and work was done by lifting a pump-rod which was fastened to the other end of the beam. The common story is that a lazy ingenious boy named Humphrey Potter, who had been set to turn the valve, made the engine close and open its own valves by means of cords and thus invented the first automatic valve-gear.

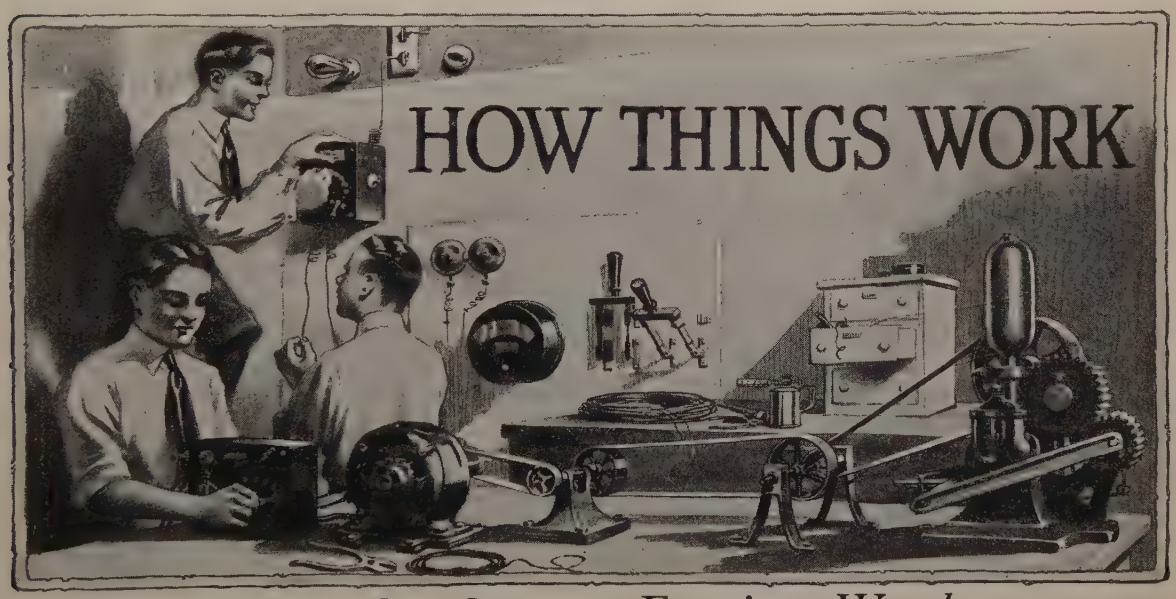
Newcomen's engines were used solely for pumping water from the English coal mines. The modern steam engine is due to James Watt (*see* Watt, James), an instrument-maker for the University of Glasgow. Watt's great advances were: (1) condensing the steam in a separate vessel called the condenser, thus keeping the cylinder hot; (2) adding an air-pump to help maintain the vacuum of the cylinder and remove the condensed steam; (3) jacketing the cylinder to prevent cooling off by conduction and radiation; (4) making the engine double acting, that is, forcing the piston back not by the atmosphere but by steam admitted at the other end of the cylinder; and (5) using the steam expansively, in other words, stopping the admission of steam when the piston had made only a part of its stroke, and allowing the rest of the stroke to be performed by the expansion of the steam already in the cylinder. He also made many inventions of important details, as the throttle valve for regulating the admission of steam, the centrifugal governor, the indicator for studying the actions in the cylinder, and, in conjunction with Murdoch, the slide valve for controlling the admission and release of steam. He also patented the use of two or more successive cylinders on one engine, or the modern compound engine plan, which is used in all large engines where economy of fuel is important. Watt's inventive career extended over more than a half-century, and he is rightly called the father of the modern steam engine.

To convert the straight line backward-and-forward motion of the piston into rotary motion, a connecting rod and crank on a fly-wheel are used. Steam engines in English-speaking countries are rated

in horse-power. A one-horse-power engine is one that has the power to raise 33,000 pounds one foot in one minute. This unit of power was adopted because the first steam engines replaced horses in pumping water from the English mines; when the mine owner bought a steam engine, he wanted to know how many horses he could discard. As a matter of fact only an unusually strong horse can lift 33,000 pounds a foot in a minute, and then only for a short time.

Various terms are used to designate different forms of steam engines. Horizontal, inclined, and vertical refer to the position of the cylinder. High and low, as applied to speed, are relative terms; a speed of 150 revolutions per minute is a medium speed; much above or below this is called high or low. Non-condensing and condensing are terms referring to the exhaust. In a non-condensing engine the exhaust is directly into the air; in a condensing engine the exhaust steam is condensed usually by contact with cool running water. Simple and compound are terms referring to the number of expansions used in the engine. In a simple engine there are a single cylinder and a single expansion; in the compound engine there are at least two cylinders and two expansions. Compound engines are more economical, and great steamship engines are usually triple expansion. A rotary engine is a form of engine in which the piston rotates, instead of moving backward and forward as in the common engine. A rotary engine has the very decided mechanical advantage of compactness and of direct application of power without crank and fly-wheel, but no rotary engine of the many that have been invented has ever shown itself economical or durable, except the steam-turbine (*see* Turbine). A locomotive is a steam engine so arranged with wheels as to drive itself on an iron or steel track (*see* Locomotive).

The boilers, formerly made of wrought iron, are now almost always constructed of steel, and steam pressures of 200 to 250 pounds to the square inch are not uncommon. Stationary engines now generally use tubular boilers in which the water circulates in iron pipes about which the heated gases from the fire circulate. These boilers are known as the "water tube" type. The Scotch marine boiler is of the "fire tube" type, in which the gases pass through the tubes, and the main shell is filled with water. In "flash" boilers, used where steam is wanted rapidly, water is forced through red-hot tubes, and "explodes" into steam. Attached to the boiler, in most cases, are a pump or injector for supplying it with water, a water-gauge to indicate the amount of water in the boiler, a steam gauge which shows the steam pressure, and a safety valve to release steam should it rise beyond the pressure which is safe for that particular boiler.



How the Steam Engine Works

THE magic of the steam engine is all in a drop of water. How little you think of it as you stand and look into some placid lake, or watch the goldfish in the pond, or see the raindrops trickling from a tree, or see a tear fall from some mother's eye! Yet all this power of steam that drives our mills and factories and engines comes from the simplest thing in all the world—a drop of water.

Without it the earth could never have supported life. For inside a drop of water is the miracle of power, the atom of gas that will do for man the work he cannot do with his own hands. You would think

it strange if some mysterious wizard should wave his hand across the Mississippi and bring out of it the power of a million horses, but it happens every day without the wizard. We light a fire and make the water so hot that the atoms of steam fly for their lives, and in flying they hit against an iron door *and move it.*

That is the magic of the steam engine—as simple as Nature, but too wonderful for human understanding. Let us see how it works; let us take the very simplest engine we can find that goes by steam. It will help us to understand the principle at work in all these other engines—the train that flies across the continent, the engines that plough through the seas, and all those hundreds of kinds of steam engines great and small. One and all, they began with a fire and a drop of water, as we see in these pictures.

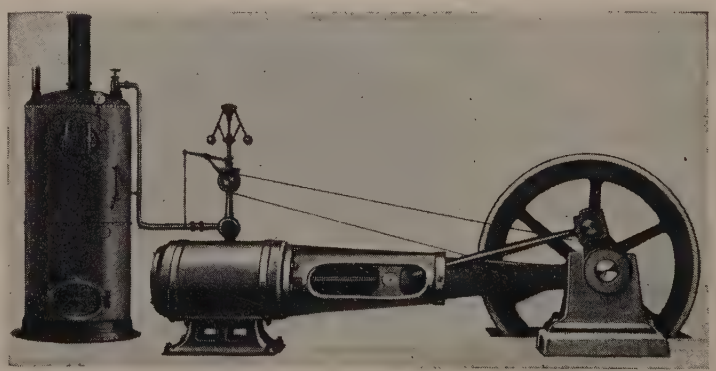
The Steam Boiler

THE STEAM BOILER

What makes a steam engine go? Where does the power come from? It is all done by the expansive force of the gas given off by boiling water. That gas is steam or water vapor. We have all watched the boiling of water in a pan over the fire and seen how, as the water gets hotter and hotter, little bubbles begin to appear over the bottom and sides of the pan, and how presently these bubbles rise and escape into the air. These little bubbles are also water, but water turned into a gas called steam or water vapor. We know that in a few minutes the water will all escape in the form of these bubbles—"boil away" is the way it is commonly described. The bubbles are as clear and colorless as air, and perhaps you have known people who have thought they were bubbles of air. When these bubbles of clear and colorless gas escape into the air, you often see a white cloud appear a little way above the water, particularly if the surrounding air is cold; this white cloud is often called "steam." The white cloud is really a multitude of minute water globules, for the clear invisible steam condenses back into little particles of water when it comes into contact with the cold air. It is such white masses of floating water particles, condensed from water vapor, that we see in the sky as the beautiful clouds of a summer day. When light is reflected from the fine particles of water, they appear white.

Now, how can we get power from this gas? As it escapes from the pan into the air, the steam has no more force than the air. But suppose we put a tight cover on the pan, and watch what happens; presently the cover is lifted by the force of the confined steam. If the cover is fitted too tight, there might be an explosion. That is, when steam is confined, it exerts force in trying to expand. The steam tends to occupy 1,600 times the volume of the liquid water, and that is why it exerts force when it is confined. It is this expansive force or pressure of confined steam that is used to run the steam engine. The water is boiled in a strong steel tank or boiler. The confined steam passes through stout pipes to the steam chest of the engine, where as described farther along, the expansive force or pressure is used to drive the piston back and forth.

There is an opening in the top of the boiler, kept closed by a metal plug held down by a spring or a weight. If the steam pressure gets too high for the strength of the boiler, the plug or valve opens to let the steam escape. Sometimes this "safety valve" is neglected; then there is likely to be an explosion, and the boiler bursts with great force and destructive effect.



The Engine

But why does water in the vapor or gas state, that is steam, exert this great force? Heating water means giving its molecules greater motion, and at 212° F. the motion of the molecules is so great that they no longer hold together, but fly apart. It is the blows of these flying molecules against the walls and the piston that produce the steam pressure. These flying steam molecules pass along the pipe from the boiler into the cylinder, as we see in the next picture.

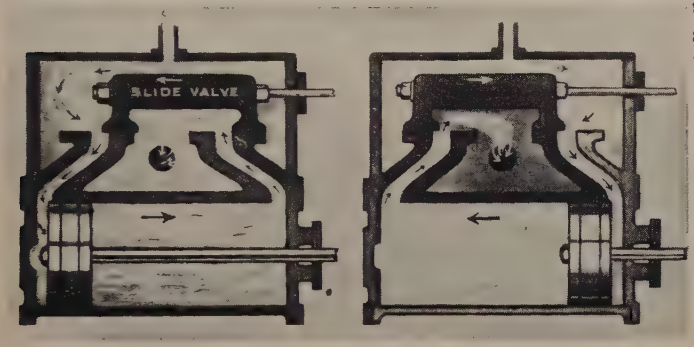
THE ENGINE

In this picture the piston is hidden, but we shall see it in a moment. Here we see the piston-rod, with

the rod that connects it to the fly-wheel, and we see, working from this wheel, the cylinder cord controlling the governor—the two beautifully balanced balls immediately above the cylinder. Simple as this engine is—the simplest form of engine we can have—it is wonderful in the smoothness of its working and the rhythmic balance of its parts.

THE STEAM-CHEST

From the boiler the gas rushes through the pipe into the steam-chest of the engine. It flies to the cylinder till it touches the piston, and here these flying molecules bombard the steel disk so hard that the disk flies back to the other end of the cylinder. Then the engine does a very clever thing. As the piston-rod flies back, another rod flies forward. The cylinder doors are fixed to this other rod; and as the piston goes back the slide valve goes forward, so that the door by which the steam came in is shut. No more steam can come that way. But as this door shuts another opens, and through this open door the steam pours in to drive the piston on again. Let us call these doors the front door and the back. They shut and open hundreds of times a minute. The



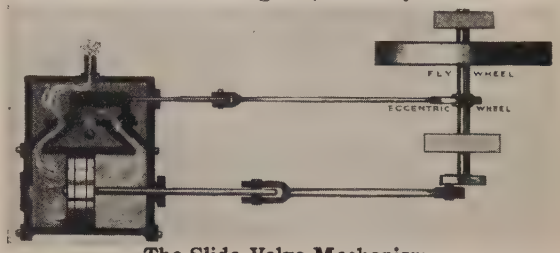
The Steam-Chest

front door opens, the steam rushes through and drives the piston on; then the front door shuts and the back door opens, and the steam through the back door drives the piston back.

No wizard's chest was ever more wonderful than this steam-chest of an engine. Inside it is the secret of the engine that works by steam-power. The ingenuity of its mechanism is well worth studying closely, and these pictures and the picture following make it all quite plain. Not only do the doors shut and open with lightning rapidity and with marvelous precision, but as the piston flies to and fro it clears the cylinder of the used-up gases, driving them into the exhaust-box through the little black hole just under the slide valve.

THE SLIDE-VALVE MECHANISM

Here, looking down on the steam engine, we see how the marvelous exactness of its movements are obtained. We see the steam rushing in and driving the piston through the cylinder. The piston-rod is joined to the connecting-rod, which joins the crank



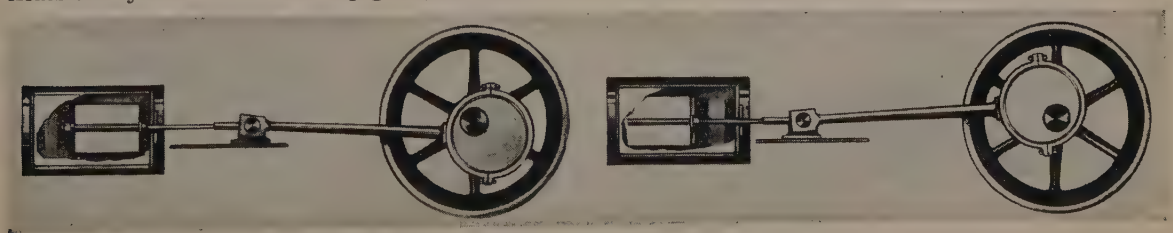
The Slide-Valve Mechanism

of the main shaft so that, as the piston-rod flies to and fro, the shaft goes round and round. In the middle of the shaft is what is called an eccentric wheel—called eccentric because the center of the wheel is not the center of the shaft. The result of this is that the wheel does not run true but has a kind of wobbling motion. The wobble affects the moving of the eccentric rod, which is joined by another rod to the slide valve.

As the piston flies forward the eccentric wheel drives the slide valve backward, shutting the door and cutting off the steam. As the piston comes one way the eccentric wheel drives the slide valve the other way—that is to say, it admits the steam just when it is wanted and where it is wanted.

THE ECCENTRIC WHEEL

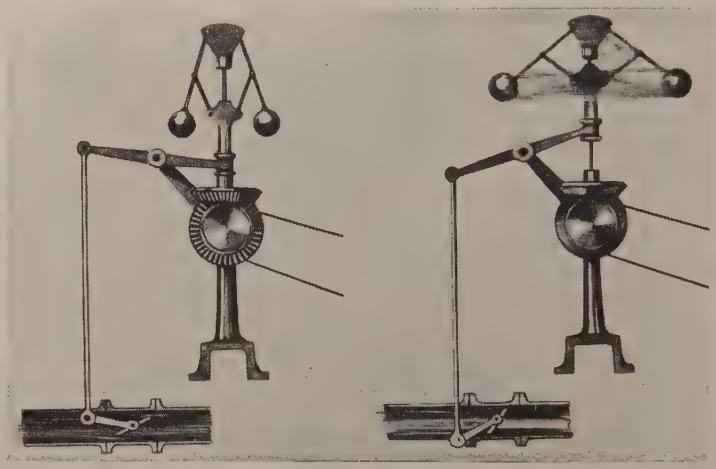
Here we see the eccentric wheel which wobbles out of its center and we see also a top view of the slide valve, or the sliding doors, as we have called them. These two pictures below show how, with the eccentric wheel in one position, the left-hand door is open and the right-hand closed, while with the wheel reversed the right-hand door is open and the left-hand closed. The steam drives the piston, the piston works the shaft, the shaft works the eccentric wheel, and the eccentric wheel works the sliding doors, which control the steam that drives the piston. That is the "round and round" of a steam engine, going on faster than we can count, each part fitting into the other, and each doing its share of the work with untiring accuracy.



The Eccentric Wheel

THE GOVERNOR

These two pictures show one of the most wonderful pieces of mechanism on any engine. It is the little instrument with the hanging balls, and is called the governor. It is connected with the main shaft and is made to revolve by two cog-wheels just below the balls. The faster the main shaft goes around, the faster these cog-wheels and the spinning balls revolve. The governor is like the "sense" of the engine, and its purpose is to regulate the supply of steam to the cylinder.



The Governor

It is all done by the two balls. We all remember the old-fashioned merry-go-rounds on which we used to ride at country fairs. The faster they went the farther out the horses swung and the higher they were in the air. So it is with a ball on a piece of string. Spin it round and round, and the faster you spin it the higher it will rise. Look at the balls in the left-hand picture—they are still and low down. Now look at the right-hand picture—they are spinning around as fast as they can go. As they spin they rise, and as they rise they pull up with them the rod that connects them with the throttle, so that the throttle works with the balls, shutting off steam when the balls are at their highest, admitting more steam when the balls slow down.

This delicate piece of mechanism was invented by James Watt, the inventor of the modern steam engine, and it is called "Watt's ball governor." In most engines now, this governor of Watt's takes another form, though it is really the same in principle. Inside the big fly-wheel of the engine are two big balls or weights fastened on hinged arms. These weights fly out toward the rim of the fly-wheel when the engine is running. Just as in Watt's ball governor there is a rod from the arms of these weights joined to the steam throttle. If the engine runs too fast, the weights fly out so that the rod closes the throttle, shutting off part of the steam, and the engine slows down to the proper speed.

Steel. Any combination of iron, usually with carbon, that is very malleable at some high temperature and is capable of hardening greatly by sudden cooling, was formerly defined as steel. The name is now generally applied to any iron obtained in a liquid state, provided it is malleable, regardless of the percentage of carbon it may contain, and regardless therefore of whether or not it possesses the property of becoming hard on cooling. Varieties of steel are classified according to the presence or absence of slag, their carbon content, and their alloy (such as aluminum steel, chrome steel, manganese steel, etc.) (*see* Iron and Steel.)

Stephen, King of England (1097?–1154). The 19 years that Stephen, grandson of William the Conqueror, reigned over England were one prolonged contest for the crown, with the result that feudal anarchy grew year by year, and the people were sorely oppressed. Although the barons in the lifetime of Henry I had sworn fealty to and recognized as heir his daughter Matilda, widow of the German Emperor Henry V, after his death they chose as King of England and Duke of Normandy the easy-going Stephen of Blois, son of Henry's sister Adele. But Matilda did not let her inheritance slip without a struggle, which she waged with varying success. Her husband Geoffrey of Anjou successfully asserted her claim to Normandy, and after his death their son young Henry of Anjou, the future Henry II of England, took up the contest. Finally in 1153 Stephen, wearied by the unending struggle and saddened by the death of his eldest son, Eustace, for whose advancement he had fought, agreed to the treaty of Wallingford, by which Henry should succeed to the throne after Stephen's death. Stephen died the year after this settlement was made.

In the meantime England had fallen into the greatest misery that ever was her lot. It was the only time when feudalism reigned unchecked in the land. Lawless castles sprang up everywhere, and their garrisons lived by plundering the people. "If three men came riding into a town," says the old English chronicle, "all the inhabitants fled." And again, in speaking of the cruelties practised by the inmates of the "adulterine" castles: "They hanged up men by their feet and smoked them with foul smoke. They put knotted strings about men's heads and twisted them until they went into the brain. They put men into prisons where adders and snakes and toads were crawling, and so they tormented them. Many thousands they starved with hunger." Such horrors lasted the greater part of Stephen's reign, owing to his weakness and the lawlessness of the barons, and were ended only with difficulty by his strong and active successor, Henry II. (*See* Henry, Kings of England.)

STEPHENS, ALEXANDER HAMILTON (1812–1883). Second only to Jefferson Davis among the statesmen of the Confederate States of America was Alexander H. Stephens, the vice-president of the Confederacy. He was a native of Georgia and rose to leadership despite a long fight with ill health and poverty. Like Davis, he had gained his experience in the United States Congress, where he served from 1843 to 1859, resigning then because he "saw that there was bound to be a smash-up on the road and resolved to jump off at the first station."

Like Davis, Stephens opposed secession, making a speech against it before the Georgia legislature in November 1860 and voting against it in the Milledgeville convention in January 1861. When he was overruled in the convention, however, he cast his lot with the South. The next month he was elected vice-president of the Confederacy.

During the war he frequently opposed the exercise of extensive war powers by President Davis, though he had been one of the first to declare that slavery, not states' rights, was the cause of the war.

At the close of the war Stephens headed the Confederate commission which met President Lincoln and Secretary Seward at Hampton Roads, in February 1865, to confer on the terms of peace. He was later imprisoned for six months in Fort Warren, Boston Harbor, but was released upon taking the oath of allegiance to the United States. His devotion to the rights of the negro won for him election to the United States Senate in 1866, but his participation in the war barred him from taking his seat. Then for several years he devoted his energies to the writing of his book, 'A Constitutional View of the War between the States', in which he set forth the Southern position on the doctrines of state sovereignty and secession. This book is generally regarded as the ablest presentation of the Southern point of view. In 1873 he was finally allowed to take a seat in the House of Representatives, in which he served until 1882, when he resigned to become governor of Georgia. He was one of the finest characters and most independent thinkers produced by the Old South.

STEPHENSON, GEORGE (1781–1848). Few great inventors had as humble a beginning as Stephenson. His father, whose earnings never exceeded 12 shillings a week, was fireman of a colliery pumping-engine in the wretched mining village of Wylam, near Newcastle, England. One room in a cottage near the pitmouth which also sheltered three other families was the home of his parents and their six children. School was not to be thought of; bread was not always to be had in sufficient quantity. In this grimy village he spent his babyhood; childhood saw him below ground. At 14 he was promoted to be his father's assistant at a shilling a day. At 21 he himself was an engine-man at two shillings, with his father under him as a fireman.

Eager to add to his knowledge of engines and steam, Stephenson at 18 entered a night school, learning at the age of 19 to write his own name. His evenings and week-ends were always full of work and study, and his self-improvement brought him steady promotion. At 31 he was "engine-wright" (builder and erector of stationary engines) at Killingworth Colliery or coal-mine, and earning $500 a year—a larger sum then than now—which enabled him to send his son to school. His connection with coal-mines stimulated him to invent a miner's safety lamp, which he perfected about the time Sir Humphry Davy produced his. Meanwhile Stephenson's position permitted him to experiment with the construction and operation of steam engines.

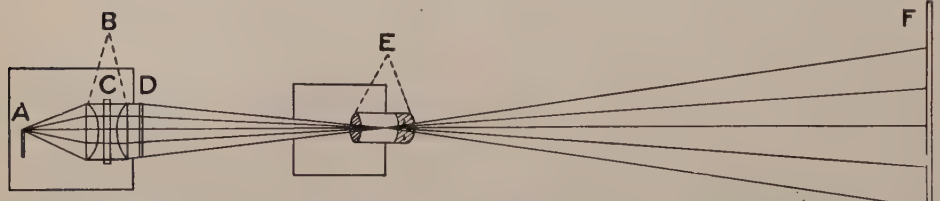
It was then the practice in such places as Killingworth Colliery to lay wooden or iron plates as tracks for the wheels of horse-drawn coal-trucks to run on. Why not use steam instead of horses to pull the trucks? The idea, in fact, was "in the air," and, after seeing experiments of the kind, Stephenson persuaded his employer to back such a project. His first engine, completed in 1814, ran successfully; in his second he improved Watt's engine by turning the exhaust steam into the chimney, thus increasing the draft and doubling the power of the engine. His engine "Locomotion," run over the Stockton & Darlington Railway at its opening in 1825, was the first ever used to draw goods and passengers. His "Rocket" in 1829 won the $2,500 prize offered by the Liverpool & Manchester Railway for the best locomotive engine (*see* Locomotive). Stephenson was now a "made man," and henceforward until he retired to live the life of a country gentleman was the great railroad builder and consulting engineer not only of England but of all Europe. His son Robert (1803–1859) was also a noted international engineer, among whose works are many railroads and famous bridges in various parts of the world. He helped develop his father's locomotive factory and later made the firm of Robert Stephenson and Company the leading locomotive manufacturers in the world, with sales in England, on the Continent, and in America.

STEREOPTICON. In the 17th century a certain learned Dane showed in Lyons, France, illuminated pictures projected on the wall by a marvelous lantern which some people imagined must have drawn its strange power from supernatural sources. Yet that old "magic lantern" was a rather simple toy compared to the complex apparatus used today for throwing enlarged images on the screens at public lectures, and for projecting moving pictures.

The principle, however, is the same in all "projection apparatus," as such instruments are called. The light passes through a set of large condensing lenses, which gather up the rays and distribute them equally over the transparent image on the slide. After passing through the slide, the beam of light, which is now carrying the image, concentrates upon the smaller objective lenses. These focus the image and project it upon the white screen where it becomes visible. (*See* Lens; Light.)

The slide consists of a piece of glass on which may be lettering, or images painted in transparent colors, or (more often) plain or colored photographs which are exactly like the ordinary photograph except that the gelatine film is supported on glass instead of on paper. In the case of moving pictures, a large number of small photographs, contained on a long roll of flexible film, pass in rapid succession behind the objective lenses (*see* Motion Pictures).

HOW PICTURES ARE THROWN ON SCREENS



The vivid light from the arc (A) is caught by the condensing lenses (B), between which is a water cell (C) which cuts off the intense heat from the arc. These lenses focus the light through the transparent picture slide (D), then the brilliantly lighted image is caught by the double-objective lens (E) and focused on the screen (F). The whole device works like a giant camera, in which the lens "photographs" the image of the slide upon the back of the camera, the room or theater playing the part of the camera box.

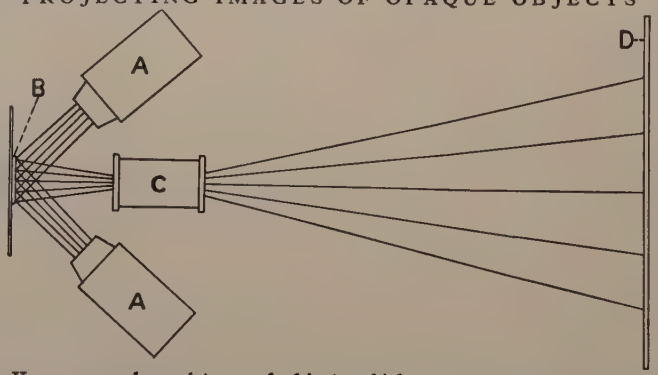
To protect the slide or film from the intense heat generated by the light, a water cell is usually placed between the condensing lenses. The light, placed in a box known as the lamp house, must be brilliant and steady. The electric arc is best; limelight makes a good substitute; a Welsbach mantle, an acetylene gas flame, or even a double or triple flame kerosene burner may be used in a small room. More recently special nitrogen-filled tungsten lamps, of from 400 to 1,000 watts, have been successfully used. These can be run from the ordinary 110-volt electric circuits of the home.

The name "stereopticon" is sometimes applied to a double lantern with the two objectives arranged to focus on the same spot, so that one view may fade into another, or a snow or rain effect may be super-imposed on a clear landscape.

There are several types of instruments for projecting on a screen images of non-transparent or opaque objects. In one of the simplest of these, the "balopticon," the opaque object is intensely illuminated by two lights, each similar to the stereopticon light. The light rays are then reflected back through lenses to the screen.

It is easier to understand the principles of projection apparatus if we compare them to photographic processes. In this case the darkened lecture hall takes the place of the camera. The objective lenses of the projector, just like the camera lenses, are focused upon the transparent slide or upon the brilliantly lighted opaque object, and project its image upon the screen, which corresponds to the photographic plate or film (*see* Photography).

PROJECTING IMAGES OF OPAQUE OBJECTS



Here we see how pictures of objects which are not transparent can be thrown on the screen. The two arc-lamps (A) concentrate intense light upon the object (B), and the reflected light from the object is focused by the large objective lens (C) upon the screen (D).

STEREOSCOPE. Of what use is it to us to have two eyes instead of one? Perhaps you think that both eyes see the same object in the same way, but such is not the case. The right eye sees more of the right side of an object, the left eye more of the left side, as you may observe by looking at an object with one eye closed, then the other. The brain puts these two images together and sees them as one object. That is how we get our impressions of solidity and relief.

The ordinary camera has only one "eye" or lens—consequently its photographs appear flat. The principle of the stereoscopic picture is the same as that of the eyes, for it presents two images taken through two lenses. Two photographs of an object or scene are taken simultaneously by a "stereoscopic" camera, so arranged that one lens photographs it from an angle slightly to the right and the other from an angle to the left. These photographs (stereographs) are then mounted side by side on a card.

The stereoscope itself is an instrument with a similar pair of lenses for viewing such photographs. The two images are blended by the brain so that we see a single picture, in which every part stands out solid with lifelike effect.

The principle of the stereoscope (from the Greek words *stereos*, "solid," and *skopein*, "to see") is used in binoculars ("double-eyed") field glasses and in opera glasses. There are also binocular microscopes and telescopes, and attempts have been made to apply the principle to moving pictures. The stereoscope is a modern invention, the first instrument of the kind having been devised by Sir Charles Wheatstone (1802–1875), English physicist and inventor, in 1832. The open form of stereoscope, which is now commonly used, was devised by Oliver Wendell Holmes, the American essayist and poet, and perfected according to his plans.

STEREOTYPING. Most newspapers are printed not from the type itself but from "stereotype" plates cast from the page "forms" in which the type has been set. The mold or matrix is made by pressing a sheet of hot moist papier-mâché (thin sheets of tissue paper pasted together) down over the "forms" so that each line and letter and dot of the type is deeply impressed in it. Pulverized clay is usually a part of the papier-mâché to give it quick-drying properties. The whole is quickly dried on a "steam table." Then the matrix is removed, placed in a mold, and melted type-metal poured in to make a solid curved plate about two-fifths of an inch thick for the big rotary presses, on which the great newspapers are printed. The whole process takes only about ten minutes after the type is in the form.

It is possible to make several plates from one matrix, and most country newspapers use columns of flat-cast stereotype plates supplied by firms in the large cities as "fillers" for their news columns. For fine work, printing plates are made by the electrotyping process. (*See* Electrotyping; Newspapers.)

STEUBEN, FREDERIC WILLIAM AUGUSTUS (1730–1794). Baron Steuben was a brave German soldier who came to America during the Revolutionary War to aid the Colonial forces. He had begun his military career when he was only 14 years old, and had served in two great European wars before he came to America. As he had been an officer under Frederick the Great of Prussia, the greatest general of the time, he was of inestimable value to the colonists in training their troops.

During the dark days of Valley Forge he turned Washington's body of raw recruits into an efficient well-trained army. He was next sent to the South to "collect, organize, and discipline" recruits, a task he carried out with rare efficiency.

After the war he spent the rest of his life in America. New York, Virginia, Pennsylvania, and New Jersey gave him grants of land for his services during the war, and Congress passed a vote of thanks, gave him a gold-hilted sword, and later granted him a pension of $2,400 a year. He died at his home near Utica, N.Y. His statue stands in Lafayette Square.

STOUT-HEARTED "R.L.S."—*Teller of Tales*

The Story of a Man Who Held High the Torch of Romance and Brave Adventure While He was Fighting a Constant Battle against Death

STEVENSON, ROBERT LOUIS (1850–1894). The history of English literature records no braver story than the life and work of the blithe and gifted story-teller, poet, and essayist, Robert Louis Stevenson. Born in Edinburgh, Scotland, he spent much of his childhood in bed, with but the frailest hold on life. He died at the early age of 44. Within a period of 20 years, while waging one long fight with death, he produced an enormous quantity of work of enduring quality. Constant pain and overpowering weakness he did not permit to affect his gaiety of spirit, nor to quench the flame of joy that burns in every line.

His brave spirit and unconquerable cheerfulness are well expressed in the following little poem:

> If I have faltered more or less
> In my great task of happiness;
> If I have moved among my race
> And shown no glorious morning face;
> If beams from happy human eyes
> Have moved me not; if morning skies,
> Books, and my food, and summer rain
> Knocked on my sullen heart in vain:–
> Lord, thy most pointed pleasure take
> And stab my spirit broad awake;
> Or, Lord, if too obdurate I,
> Choose thou, before that spirit die,
> A piercing pain, a killing sin,
> And to my dead heart run them in.

In the autobiographical poems entitled 'A Child's Garden of Verses' Stevenson shows how, shut away from ordinary childish pleasures, he created a wonderful world of romance out of the simplest things. His bed was "the pleasant land of counterpane," not a weariness. His mother read to him the stories which he loved to hear and his devoted nurse Alison Cunningham kept him alive by her tender care. Years later, according to Balfour, his biographer, he told this pious old lady that it was she who had given him a taste for the drama. She indignantly answered that she had "never put foot inside a playhouse" in her life. "Ay, woman," said he, "but it was the grand dramatic way ye had of reciting the hymns."

When he grew older, he was able to take the course in Edinburgh University and to study engineering and law, but no regular study was possible in childhood. So he lived much of the time in a beautiful country home or took journeys with his father, a civil engineer, inspecting lighthouses and harbors about the wild coast. In this way his brain was filled with images of mountain, moor, and sea-girt isles, rather than with the symbols in books. His frail health very early settled the question as to whether he should carry on his father's business of engineering, practice law, or devote himself to literature.

He spent several years in wanderings through France, Germany, and Scotland for the benefit of his health; and records of these journeys were given to the world in 'An Inland Voyage' in 1878 and 'Travels with a Donkey' in 1879. Readers were charmed by Stevenson's delightful conversational manner, by the graceful and easy flow of his style. They did not realize how hard a schooling he had given himself in his preparation for literature, nor how he continued to labor in order to achieve perfection. In 1887 he wrote in a letter, "I imagine nobody had ever such pains to learn a trade as I had; but I slogged at it

day in and day out; and I frankly believe (thanks to my dire industry) I have done more with smaller gifts than almost any man of letters in the world."

With the publication of his first long tale, 'Treasure Island', in 1883 Stevenson became widely popular. He wrote many essays, poems, and short stories, and then in 1886 another absorbing story of adventure, 'Kidnapped'. Stevenson did not concern himself with the problems of life and society, the mysteries of thought and conduct into which George Eliot and Thomas Hardy and other realists of the 19th century delved so deeply. He returned to the pure romanticism of Scott—the love of a story for its own sake, the delight in adventure, the spirit of eternal youth.

The great romance of Stevenson's own life began in France in 1876, when he met Mrs. Fanny de Grift Osbourne. Stevenson knew immediately that she was the one woman for him. But there were many difficulties. She had returned to her home in San Francisco when Stevenson, hearing that she was ill, decided to follow her. He crossed the Atlantic in the steerage and the continent in an emigrant train. The experience gave him material for several books but, together with the hard times he suffered in San Francisco, nearly killed him. He developed tuberculosis and would have died, had it not been for Mrs. Osbourne, who nursed him back to health. In 1880 they were married, and Stevenson returned with his wife and stepchildren to Scotland, where they were welcomed into his father's home. The stepson, Lloyd Osbourne, collaborated with Stevenson in some of his stories and later won considerable distinction as a writer on his own account.

Stevenson could not stand the severe climate of Scotland and so for years he wandered from place to place in search of a climate where he might live and work. At last he settled with his family in one of the Samoan Islands in the South Pacific. Here he gained four more years of life and of fairly good health. The end of the brave struggle came quite suddenly in 1894. While talking gaily on the veranda of his house at Vailima he had a stroke of apoplexy from which he never recovered consciousness. The natives, who had come to regard him as their beloved chief, carried his body to Mount Vaea, cutting a path to the summit with their knives and axes. There they buried him and there he lies today in the green place of trees and birds and windswept solitude, with one of his brave verses for an epitaph:

Under the wide and starry sky,
Dig the grave and let me lie.
Glad did I live, and gladly die,
And I laid me down with a will.

This be the verse you grave for me:
"Here he lies where he longed to be.
Home is the sailor, home from the sea,
And the hunter home from the hill."

STEVENSON ARRIVES AT HIS ISLAND HOME

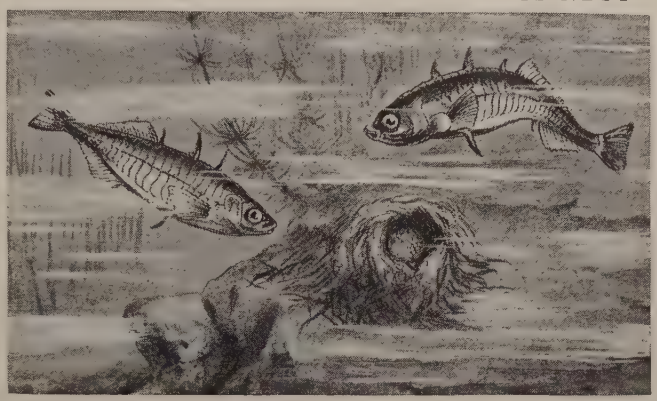
Here the great story-teller—Tusitala, the natives called him, "teller of tales"—has just landed on the little island of Upolu, where he spent his last years. With him are his wife and his stepson, Lloyd Osbourne.

Stevenson's best known works are: 'An Inland Voyage' (1878); 'Travels with a Donkey' (1879); 'Virginibus puerisque' (1881); 'Familiar Studies of Men and Books' (1882); 'New Arabian Nights' (1882); 'The Silverado Squatters' (1883); 'A Child's Garden of Verses' (1885); 'Prince Otto' (1885); 'The Strange Case of Dr. Jekyll and Mr. Hyde' (1886); 'Kidnapped' (1886); 'The Merry Men, and Other Tales', including 'Markheim' and 'Will o' the Mill' (1887); 'The Master of Ballantrae' (1889); 'The Ebb Tide' (1893); 'David Balfour' (1893); 'Weir of Hermiston' (unfinished).

For any subject not found in its alphabetical place see information

Stickleback. The life of this little fish is short, but full of excitement. At the age of three years he has lived out his time, but he usually dies as he lived, by the "sword" which he and his kind carry on their backs. He is a tyrant, cruel toward the weak, insolent toward the strong, always seeking a fight, and usually finding it. Yet the male stickleback combines with his ferocious fighting qualities a great domestic virtue. It is he who builds the tiny nest in which the female lays her eggs, and it is he who guards it jealously until the young are hatched.

MR. STICKLEBACK DEFENDING HIS NEST



If you don't want trouble, you'd better keep out of Mr. Stickleback's front yard; for that little home nest under the water is the dearest place in the world to him and he will defend it with his life!

Sticklebacks are found throughout northern Europe and America, where they live in streams usually not far from the sea. They grow at the most to be three or four inches long, but they carry sharp spines or thorns on their backs, which are formidable weapons against fish much larger than themselves. During the first year of their lives, they gather in small friendly groups. But with the return of the next summer, each male selects a territory which he fiercely defends against all comers, fighting other intruding males to the death. In these duels the sticklebacks dart at each other, striving each to get the position of vantage which will permit him to rip open with his sharp spines the abdomen of his foe.

Once established as master of his territory, the male stickleback builds his tunnel-shaped nest, binding bits of water weeds together with a tough white thread which he produces from an internal gland as a spider does its web. Then he assumes his bridegroom's dress of blue and red tints, and invites the female stickleback to share his home and lay her eggs. When the nest is filled, he enters it and mounts guard, his head thrust out to watch the enemies. If a big fish or even a man's hand approaches, he sallies forth with spines erect to give battle. So successful as a rule is he that he is shunned by all.

But jealous as he is of his own rights, he has no respect for those of others. He delights particularly in eating the young of other fish, and his capacity is enormous. A small stickleback in an aquarium has been known to devour in five hours' time 75 newly hatched dace, each about one-quarter of an inch long.

There are several species with varying numbers of spines. The common species (*Gasterosteus aculeatus*) has three or four, while the sea stickleback (*Spinachia vulgaris*), which attains a length of seven inches, is armed with 15 spines. The brook stickleback (*Eucalia incarstans*), which is abundant in small streams from New York to Kansas, grows only two and one-half inches long, but has five short spines.

Stockholm, Sweden. Broad swirling streams of shining blue water, with hundreds of little steamers and ferry-boats darting to and fro like water-bugs on a pond; miles of spacious docks, quays, and terraces stretching along the twisting waterways; fine wide boulevards and spacious stone-flagged public squares; many glimpses of green parks, bright flowers, and stately trees showing here and there in the long vistas of handsome buildings; the whole framed in a background of black primeval forest stretching almost to the city's edge—these are some of the impressions that crowd in on the traveler when he arrives at Stockholm, the capital of Sweden.

"The most beautiful capital in Europe" and "the Venice of the North" are phrases often applied to this city of the northland—so far north that it is almost on a line with the farthest tip of Labrador. Stockholm lies on a group of hilly islands and peninsulas in the midst of a veritable labyrinth of fiords and bays, streams, and straits. One-seventh of the space within its limits is occupied by water, and in traveling from one part of the city to another, one is as likely to take a steamer as a street-car. Water is in sight, it is said, from half of all the houses of the city, and there seem to be more quays and sea-terraces than streets.

But the similarity to Venice ends there; for unlike Venice, where the whole city lies on a level with the water, many of the streets of Stockholm are so precipitous that elevators or steps are used to get from one street to the next above, and tunnels are built from street to street through the solid rock, which crops out in great bare ridges in the most unexpected places.

Much of Stockholm's charm comes from the profusion of trees and gay flowers that embower it, more than one-fourth of all its area being given over to parks and gardens. And if you should happen to visit it on Midsummer Day (June 24), you would find the whole city a mass of verdure. For that is the gladdest, gayest holiday of all Scandinavia, when the delicate drooping branches of the birch, clad in their fresh green livery, are hung out from every doorway and every window, and even adorn the horses. At night huge bonfires—twice the height of a man—are kindled, setting the sky in a glow that is seen far and wide. All is color and song and merrymaking in honor of the fleeting summer, prized all the more because of its short span. And brief though it is, the people of

Stockholm make the most of it, spending their evenings in the parks and gardens and open-air cafés listening to music until the sharp chill—never absent from the night air even in mid-summer—drives them shivering home long before the last gleams of the lingering twilight of the north have faded from the midnight skies.

Some Historic Landmarks

The city falls into three principal sections, as we see if we take our stand on the Norrbro (North bridge), the handsome granite structure which links the modern business section of the city to the north (Norrmalm) with the island Staden, where the old city was founded in 1255. Between Staden and the northern district, with its many fine public buildings, lies the little Holy Ghost Island, on which is located the splendid new Parliament Building.

Looking south toward Staden, we see in a corner of the island the Royal Palace, one of the stateliest royal residences in Europe. Near the palace is the old St. Nicholas Church (1264), where the kings of Sweden are crowned, and beyond this is the Stortorg (large market), where in 1520 occurred the terrible massacre of nobles ordered by King Christian II of Denmark, called the "Stockholm Blood Bath." West of Staden on a little island is Sweden's chief temple of fame, the Riddarholm Church with its perforated iron spire 295 feet high. Except when a member of the royal family dies, no services are held here; for since the time of Gustavus Adolphus (1594–1632) this church has been the burial place of the royal family. From the south end of Staden, two iron bridges lead to Södermalm, an old southern quarter of the city, whose steep rocky heights rise 120 feet above the water's edge.

An Open-Air Museum

Looking east from the Norrbro we see another island (Skeppsholm), the headquarters of the Swedish navy. And beyond it rise the beautiful wooded heights of the island of the Djurgården or Deer Park. Here is Skansen, the picturesque and interesting 70-acre park illustrating the fauna and flora as well as the habitations and costumes of the peasants in the different parts of Sweden.

Stockholm is the chief cultural as well as the industrial and commercial center of Sweden. It is the seat of the principal learned societies and royal academies, as well as of the Caroline Institute, the leading medical school of the country, and the University of Stockholm. There are technical schools giving courses in agriculture, forestry, mining, engineering, etc., and renowned museums of art, antiquities, natural history, and anthropology.

The city has a good harbor, which is kept open by ice breakers during the winter months. It is noted for its iron and steel products: dairy machinery, bridges, engines, turbines, and pneumatic tools. Other industries include shipbuilding, tanning, manufacturing of textiles, and pottery. Population, about 410,000.

STOCKS AND BONDS. To stocks and bonds we owe those great "pioneers of civilization," the railroads, along with the other great industrial enterprises built by corporations; for our railways and factories are often of such magnitude that they could never have been paid for by one man, or even a small group of men.

Suppose a branch railroad is needed which will cost $10,000,000. The promoters make application to a state government, and receive permission to form a "joint stock company," or corporation (*see* Corporations). The capital needed is divided into parts or shares—say 100,000. Each share is represented by a piece of paper called a stock certificate, and is offered for sale at $100. This amount is called the "face," "nominal," or "par" value of the stock; it is usually stated on the certificate, but occasionally stock is issued without face value. People with small savings are able to buy one or more shares of the stock and thus the capital is obtained.

The holder of stock is a part of the company issuing it, with a right to one or more votes in directing its affairs and selecting its directors. If the corporation is successful and makes profits, it divides part of them among the stockholders in the form of "dividends." If it is not successful, the stockholder receives no dividends. In some states and in the case of national bank companies the stockholders are liable for the debts of the company, up to the nominal value of the stock held.

Why Stocks Vary in Value

The value of stock depends upon the earning power of the company. Stock which has been bought for $100 may earn so much in dividends that it can be sold for twice or three times that sum; or so little that it cannot be sold at all. Because it fluctuates so greatly in value, common stock is subject to more speculation than are other securities.

Dividends are paid either quarterly, semi-annually, or annually. If the company wishes to distribute extra earnings, it may pay an "extra" dividend in addition to the regular ones. Also, companies which have prospered and increased their property holdings or acquired other valuable assets may bring the amount of capital stock up to the amount of their property by issuing new stock to the stockholders. Such a distribution is known as a "stock dividend."

Besides "common stock," companies often issue "preferred stock." This gets its name from the fact that its owner is entitled to dividends at a specific rate before any return is made on the common stock. If you own a share of 7 per cent preferred stock, with a par value of $100, you may expect to receive $7 each year, if the company earns profit enough to pay it; but, regardless of the earnings of the company, you will not receive more than $7. If your preferred stock is "cumulative," however, and the company does not make profits for five years, you are entitled to $35 out of any subsequent profit, before the holder of common stock receives anything.

Sometimes the company promises to pay dividends as follows: first, the fixed rate on the preferred; second, dividends up to a certain amount on the common; third, any remaining profits are to be divided in a definite ratio between the holders of the preferred and common issues. When such an arrangement is used, the preferred stock is known as "participating."

Preferred stock is often issued as a means for borrowing money for needed expansions, and provision is made for retiring the stock by paying back the money at fixed or optional dates. The more usual means, however, for obtaining such loans is by issuing *bonds*. These are positive promises to repay at the end of 20 years or some other period, and in the meantime to pay a specified rate of interest on the borrowed money. The obligation is binding whether the holders of preferred and common stock receive dividends or not.

Usually bonds are secured by a mortgage on part or all of the company's property. The mortgage is made out to a trustee who represents the bondholders. If the company fails to pay interest as promised, or to repay the principal, the trustee forecloses the mortgage, sells the property, and distributes the proceeds among the bondholders. Sometimes—particularly in the case of railroads—a property may be mortgaged for only a small part of its value, and bonds issued against the mortgage. Then later, when the company needs more money, it may place a "second mortgage" upon this property and issue more bonds. Such bonds are known as "second mortgage" or "junior lien" bonds, because in case of default the holders of the "first mortgage" or "senior lien" bonds must be paid before the others can get anything.

Sometimes, instead of promising to repay the entire loan at one time, a company proposes to repay a certain number of bondholders every year. The bonds to be repaid are usually chosen by lot, and are known as "serial bonds." In the case of either stock or bonds, if the sale contains provision that the security can be rebought by the company at a specified price, the security is said to be "callable" at that price.

"Collateral Trust" Bonds

Instead of mortgaging real property, a company may mortgage valuable stocks and bonds as security. Such an arrangement is called a "collateral trust" and bonds issued against it are called "collateral trust bonds." Sometimes strong companies issue certificates promising to repay principal within a short term—usually five years or less—against their credit and reputation, without any mortgage. Such certificates are called "notes." Many short term bonds secured by mortgage are also called "notes." A "gold bond" is a promise to pay interest or principal or both in gold, instead of "legal tender," but in the case of American companies is not much more valuable than any other kind, because like all other bonds its value depends upon the probable ability of the company to repay, and the value of the property pledged by mortgage to secure it. In buying securities from a foreign country or company, however, gold bonds are preferable because payment in gold avoids any possibility of loss through fluctuation in "exchange," or the relative value of the money of the two countries.

Because of the mortgage security, bonds are usually a safer investment than stock, but the rate of interest is usually less than the returns on stock in a prosperous company. Cities, counties, states, and national governments also frequently issue bonds as a means of borrowing money, as in the case of the Liberty Loan bonds, and such securities are among the safest investments that one can make. (For the computation of the interest or "yield" on bonds when above or below par *see* Percentage and Interest.)

Factors to Consider in Buying Bonds

The factors of value in a bond are three: (1) safety, (2) yield, (3) market. Unless the mortgaged property is clearly enough to cover the obligation in case of default, the bond is not safe. The yield, or rate of interest, should be equal to the current rate for sound investments at the time. Any broker can tell you what this is. Finally, there must be an active "market," or known place where buyers can always be found, or you may be unable to sell the bond should you need the money, even though it is sound. Inexperienced investors are particularly likely to overlook this need for a market, when considering a purchase of bonds.

Companies keep a record of stockholders, and often provide that if the stockholder wishes, no transfer of his stock will be recognized until after he has notified the company. This protects the owner against loss by theft and similar causes. Many companies also give this safeguard to bondholders. Such securities are said to be "registered."

It is usually impossible for a corporation which has stock or bonds to sell to reach the thousands of investors who might be interested in its enterprise, and even if it could, the people might not be sure of the exact value of the securities. In the case of good properties, therefore, the promoters of the company usually sell the entire issue outright to a group of brokers or bankers who have combined to buy it. Such a group is called a "syndicate," and when they have bought the issue, the members of the syndicate conduct the sale throughout the country.

So far we have only considered the purchase of stocks or bonds when the company issues them. Often, however, a man may want to sell his holdings of stocks or bonds. In order to do this, he usually avails himself of the service of a "stock exchange," provided the stock is "listed"—that is, provided it is dealt in by the exchange. A new company therefore endeavors to get its shares "listed" on a stock exchange—preferably the one in New York, which, next to that in London, is the largest in the world.

Wall Street, where the New York Stock Exchange is situated, is the great center for the buying and

selling of the stocks and bonds of America's industries, and next to the London exchange is the greatest stock and bond market in the world. Thousands of investors all over the country keep in touch with the prices of securities on the New York Stock Exchange, either through their banks or "brokers" who engage in buying and selling stocks and bonds, or through the reports published in the daily newspapers all over the country. Thus an investor may know at any time the exact value of securities, and can judge when it is profitable to buy and when to sell. Membership on the Stock Exchange is restricted to a small number of dealers and costs thousands of dollars, but any individual, bank, or broker can buy or sell through members, paying them a small percentage called "brokerage" for their services. (*See* Boards of Trade.)

Many less well-known securities, which are not listed on the Stock Exchange, are dealt in on the "curb" market. This receives its name from the fact that until 1921 it had no building, but transacted its business on Broad Street, near Wall Street in New York, sometimes overflowing the curb and sidewalks and spreading over the whole street. Many securities, however, are not well enough known to be listed on any exchange, either in New York or any other city, and as a rule the inexperienced investor will do well not to buy them. Even if they are good—and many of them are—he will not know where to turn for a purchaser in case he should want to sell, or know what their proper value is, should he find someone willing to buy.

Since many persons have suffered financial loss through the purchase of worthless securities from unscrupulous promoters, "blue sky laws" have been enacted in a majority of the states to protect investors from concerns that have nothing to sell but the "blue sky," and worthless stock certificates.

A NEW STONE AGE RELIC

The hands that so cunningly shaped this bowl, with its graceful curves and herring-bone decorations, withered into dust untold centuries ago; for this bowl, dredged up from the River Thames, dates from the far-off Neolithic times when our remote ancestors had just learned to make pottery.

STOMACH. When you swallow a mouthful of food the first stopping place of that food is the stomach, an irregular cone-shaped bag, which is one of the principal digestive organs of the body. When it is empty it hangs almost vertical; when filled it swings oblique or crosswise in the abdomen.

Four layers of tissues called coats, or tunics, form this bag. From the inside out they are the mucous, submucous, muscular, and serous. The muscular coat makes this bag very elastic. Ordinarily it is about 12 inches long and four inches across, holding about three pints. However, the ability to stretch enables it to hold larger quantities of food and drink. There are two openings into this bag: one at the top, opening from the gullet (or oesophagus), called the "cardiac orifice" and the other opening into the small intestine, and called the "pyloric orifice."

In the mucous lining of the stomach are found certain cells or glands whose business it is to manufacture the gastric juice. This is one of the digestive fluids and is made up largely of water, salts, hydrochloric acid, pepsin, and renin. The peculiar churning movement of the stomach mixes the food with this liquid which dissolves it and also changes certain parts of it. (*See* Digestion.) If these gastric glands fail to produce the proper kind of juice, we have indigestion. A sour taste in the mouth indicates too much acid; a sweetish taste, too much pepsin. If we exercise care in eating we need never have that disagreeable experience called stomach-ache.

Much of what we know about the stomach and the gastric juice is due to the careful observations made by a United States army surgeon named Dr. Beaumont. At his army post on Mackinac Island, in 1822, he had as a patient Alexis Saint-Martin, whose stomach had in it an unhealed gunshot wound. His general health was unimpaired, and by keeping the body wound open, Dr. Beaumont was able for years to watch the stomach at work.

STONE AGE. A rough stone picked up by the river's edge was the first weapon and the first tool used by man. Scientists tell us that this happened about 300,000 years ago. Whenever it was, we may imagine a man climbing down from his tree home, and finding a nut too hard even for his strong teeth. He picks up a stone and crushes the nut. Perhaps it is not fit to eat. But he forgets that in the joy of having invented the first hammer.

Then man began gathering stones, round ones to throw at birds and small animals, and heavy ones to crack oysters and nuts. Perhaps he cut himself with a sharp stone and so discovered the first knife or hatchet.

Some thousands of years later, the descendants of these early tree dwellers became dissatisfied with the shape of their stone tools and weapons. One of them succeeded in chipping a piece of flint into a more useful shape. He is the first great inventor. With him began what scientists call the Old Stone Age or the Paleolithic Age.

The discovery that flint would flake off leaving sharp edges must be ranked as one of the great discoveries of that early world. It enabled man by means of his improved weapons to wage a successful battle against wild beasts, and to obtain food by hunting large game. Thus he developed the energy and confidence which enabled him to make further steps forward in civilization.

For perhaps 150,000 years the rough chipping of flint for spears and hatchets, knives and arrows, continued. The workmanship became finer and new tools were invented for scraping flesh from skins and for drilling and cutting bone and horn. Soon these last materials began to be used for weapons, along with

MUTE MEMORIALS OF THE ROCKY PATH OUR FOREFATHERS TRAVELED

When these implements were made, men had already taken several great strides along the rocky path of civilization. The flint knives and arrow heads shown in 1, 2, and 4 are great improvements over earlier implements, for they have been chipped by pressure. Flint is so brittle that bits of it will snap off when a hard piece of bone is firmly pressed against it. This process, one of the triumphs of the New Stone Age, produces a far keener cutting edge than the older method of chipping flint by blows with another stone. The polished stone axes and hammers (3) and the bone needles and harpoons (5) give further evidence of the progress of this period.

stone. Rude fish-hooks were made, and arrows with barbed points. This was the age of the Cave Men (*see* Cave Dwellers). Later still came the New Stone or Neolithic Age, when men learned to grind and polish the rough edges of their flint tools and weapons so that a knife would cut more easily and a spear be driven into an animal more surely. Last came the discovery of metals, chiefly copper and tin, which ended the Stone Age altogether and ushered in the Age of Bronze.

It is largely through the study of such old flint weapons found in all parts of the world that scientists are able to trace the story of early man. But in many parts of the world the use of stone implements continued into modern times, and the American Indians were using stone pointed arrows when the white men first came.

Among the relics which are believed to date back to the Stone Age are the monuments of huge rough stone found in great numbers in many parts of the world. They consist usually of large single stones (menhirs) set on end in the midst of a plain, or of groups of such stones (cromlechs) arranged in circles or squares, or of stones set side by side with a third stone bridging the top (dolmens).

Often these monuments show signs of having been rudely hewn by the prehistoric architects, and occasionally drawings and carvings of mysterious symbols appear upon them. Many of them are believed to mark the burial places of noted chiefs, while the "circle-stones" may have been meeting places of the skin-clad clans. Great Britain and France are particularly rich in these relics, the most famous of which is the combination of "circle-stones" and dolmens called Stonehenge, on Salisbury Plain, England. Northern Africa, India, South America, and even some of the tiny Pacific islands have important examples of this earliest form of the builder's art.

Frequently these monuments stand far removed from any stone deposits. How such huge blocks were transported and set up by primitive men will probably always remain a mystery. Some monuments of this kind have been traced to the Bronze and Iron ages, but they are usually much smaller than those ascribed to the Stone Age. (*See also* Civilization.)

STORAGE BATTERY. The electricity that starts the engines and operates the lights of our automobiles is supplied from the ingenious appliance called the storage battery. Electric automobiles and trucks run entirely on the current supplied by storage batteries, as do submarines when they are traveling under water. Storage batteries light our trains and our mines; propel the multitude of little locomotives and trucks that carry the heavy loads at wharves, freight depots, and industrial plants; and are used for an immense variety of other purposes. In the future it is likely that they will be even more widely used, especially for motor vehicles, to lessen the drain on the world's fast-diminishing petroleum supply.

It is common to speak of the storage battery as if it were a device for actually storing electricity, like the Leyden jar; but what it does is only to generate electricity as the result of chemical action, like any other sort of battery. But while other batteries, once they have been exhausted, can be renewed only

by putting in fresh solution and new positive plates, the storage battery is renewed by merely passing an electric current through it.

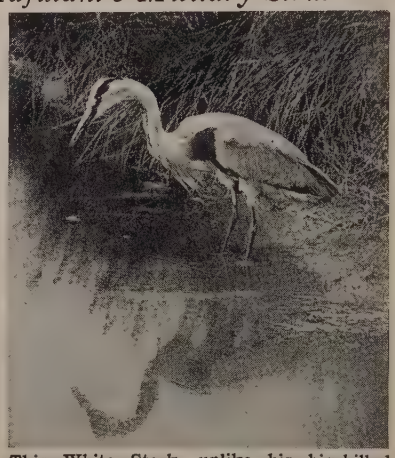
The oldest and most generally used type is the lead battery, in which peroxide of lead is used for one of the plates and spongy metallic lead for the other. When these are immersed in diluted sulphuric acid and connected by an electrical conductor, the chemical action sets up an electric current which continues until most of the lead peroxide has been reduced to lead. Now if an electric current from some other source is passed back into the cell, the chemical process is reversed, and one of the lead plates is again converted into lead peroxide. This process is known as charging the battery.

In the alkaline battery, brought to perfection by Thomas A. Edison, the positive plates are nickel hydrate, the negative plates are iron oxide, and the solution is caustic potash. The Edison battery has greater capacity in proportion to weight than the lead battery, and can stand harder usage; but it is less efficient and constant. (*See also* Electricity.)

The SOLEMN FISHERMEN *of the* MARSHES

Birds that Walk on Stilts—Voiceless Courtship of the Stork—His Grotesque Ideas about Dancing—The Adjutant's Military Strut—Long Flight of the Cranes

STORKS, HERONS, AND CRANES. "Stilt-walkers" is a term that describes these wading and marsh-dwelling birds, for balanced on their long slender legs they are able to go about through the muddy slime of the swamp and yet keep their beautiful plumage in immaculate condition. They are found in most parts of the world, generally along shores or muddy flats. They feed on fish, small water creatures, and water plants, and most species eat also meadow mice and some seeds and grains.

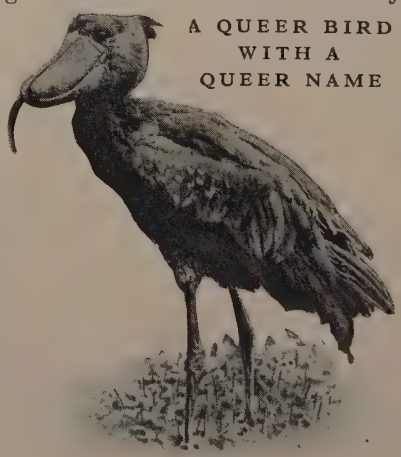


This White Stork, unlike his big-billed brother below, is careful when wading about to keep his plumage neat and clean.

The stork is the favorite of the entire group, for he is the "good-luck bird," fabled in Germany to bring the babies. Of the different varieties of storks the best known and the hero of fable and folk-story is the common white stork, found during summer in most of the countries of Europe. It breeds from southern Sweden to Spain and Greece, and winters in Africa and India. Its favorite nesting place is on the roofs of tall buildings; and on many house-tops in Denmark, Sweden, and Holland platforms are erected to induce the stork to build there. The birds return to the same nest year after year, each season adding to the rough sticks composing their nest, until the pile sometimes reaches a height of several feet.

In Europe storks are carefully protected, which accounts for their friendly confidence in human beings. The tall bird, with its white plumage, set off by the black wing quills and red beak and legs, is a beautiful sight as he stalks about the meadows searching for his supper. The stork has no voice, and during the mating season, when other birds express themselves in song, he goes through the most grotesque antics, leaping, bounding, and wildly flapping about with chattering beak.

A QUEER BIRD WITH A QUEER NAME



No wonder the Arabs of the White Nile, where he makes his home, call this stork "Abu Markub," for it means "father-of-the-shoe." Other names are "Shoe-bill" and "Whale-headed Stork."

The adjutant is a gigantic stork-like bird found in southern Asia. It stands about six feet high and has a wing span of nearly 14 feet, and it gets its name from its stiff military attitude and strutting walk, resembling the army officer called an adjutant. The plumage is a sod-colored slate above and grayish-white beneath. From the under side of the wing are taken marabou feathers so popular for the soft fur-like trimming women's garments. Unlike the other members of its family it is a carrion feeder. In villages and towns of India it may be seen stalking freely about the streets, where it acts as a scavenger. It sometimes catches crows on the wing, and is able to swallow a kitten or a fowl.

The American wood stork, called also the wood ibis, is the only member of the stork family found in considerable numbers in the United States. This white bird, which stands about four feet high, breeds in great colonies in the cypress swamps of Florida; and after the nesting season it wanders north sometimes as far as the marshes of Pennsylvania and Michigan.

Closely related to the storks are the ibises, of which species vary greatly in size and color.

SNAP-SHOTS AT THE FEATHERED STILT-WALKERS

Here are various interesting episodes in the lives of the stilt-walkers in feathers: 1. Common Herons in flight from a feeding ground. 2. Cranes in wedge formation in migration time. 3. When Mother Stork comes home from market. In the background are several others, standing about on one leg, and surveying the landscape from chimney tops. 4. An Adjutant of southern Asia about to catch a hooded crow. 5. The Sacred Ibis of Egypt dines on frog.

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The sacred ibis was revered by the ancient Egyptians and was allowed to go about the temples at will. It was the subject of many superstitions and at its death was mummified, as is shown by the many bodies of these birds that are found in the tombs of ancient Egypt. The ibis is still common to the valley of the Nile.

The white ibis, common in both North and South America, is entirely white, except for a few outer feathers of glossy black. At breeding time these birds come to the bird reservation at Orange Lake, Fla., to the number of 9,000 pairs, where they build in alder trees, placing the nests from one to 15 feet from the ground. The trees are often so filled with sitting and perching birds that they appear to be weighted with snow. The eggs are beautifully spotted and the baby birds have cunning caps of black down. This island reservation is infested with water moccasin snakes, vultures, and fish crows, which continually rob the nests. When this occurs the female ibis lays more eggs. The warden in charge of the reservation estimated that one year each female bird laid an average of 11 eggs, although the normal number is but four. The birds fly in long ranks, and are a beautiful sight as they travel to and from their feeding grounds, often a distance of several miles. The white ibis occasionally breeds as far north as the patches of swamp country to be found in Illinois.

The common stork is white but the Black-necked Stork is marked as you see him here. This black is relieved by a tinge of bluish-green.

The spoonbill is a relative of the ibis. It has a long broadly expanded bill, more like a paddle than a spoon, with which it gathers insects and shell fish from the mud in shallow water. The European spoonbill is white, the American roseate is white flushed with pink.

THE MONARCH OF THE HERONS

The Great Blue Heron who is here displaying his royal wings is the largest of the American herons and a most stately and dignified bird he is. You should see him fish! Standing in the water, still as a statue, with his long neck doubled into a capital "S," let a frog swim within range and with a stroke quicker than your eye can follow the frog has been seized in that long bill. In another second he has disappeared; and again the statuesque pose.

The heron family is as widely distributed as is that of the stork. The many species are characterized by their thin bodies and necks, straight narrow beaks, large blunt wings, and patches of down feathers. Several species, such as the egrets, have elongated feathers on the top of the head and other parts of the body. Except during their breeding season herons are generally seen alone. Their nesting-places are known as heronries and there are often 150 of their loosely constructed stick-nests in one colony. The eggs number three to six and are of a bluish-green color. When the nesting season is over the birds resume their solitary habits.

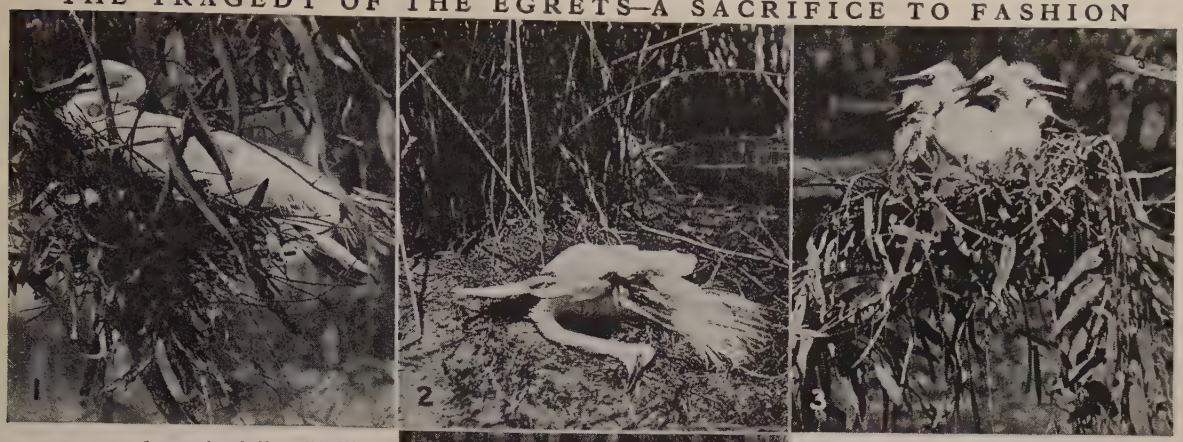
The great blue heron is the largest of the family, standing about four feet high with a wing spread of about six feet. Its upper feathers are a slate blue, with under feathers almost black. The head is crested with long plumes. (For illustration in colors, *see* Birds.)

This bird is a great fisher. He stands statue-like in the water, until his keen eyes discover a fish coming toward him. Then, at exactly the right instant, with one sudden stroke of the bill the fish is seized. Sometimes he stalks slowly through the shallow water, lifting each foot above the surface and so cautiously sliding into the water again that scarcely a ripple warns the crawfish or frog he is seeking. The blue heron is still found throughout the Western Hemisphere, though it is not so plentiful as formerly.

The little green heron is probably the best known American heron. It is only 18 inches in length, of a dark green color above and brown below. The thrust of its sharp beak is always accurate and quicker than the thrust of an

Except the rare Great Whooping Crane, the Sandhill Crane is the largest of his family in America. His height is nearly that of the average man.

THE TRAGEDY OF THE EGRETS—A SACRIFICE TO FASHION



expert swordsman's foil. Unlike other herons the green herons nest in solitude. The common heron of Europe closely resembles the American blue heron and inhabits the central part of the Eastern Hemisphere.

The egret or great white heron, is one of the most wonderfully adorned birds of the western world. Its plumage is pure white, and during the mating season the bird wears a magnificent train of long plumes springing from the back and extending a foot or more beyond the tail. This adornment has given the egrets a pathetic history. The plumes grow early in the season, but the feather-hunters know better than to attack a colony at this season, for the killing of one bird might cause the whole colony to scatter. So the millinery agents wait until the eggs are hatched; then, though its neighbors are shot down, the parent egret will return to its young again and again, only in the end to meet the fate of its mates. The orphaned fledgelings are left to starve, and so where once these lovely birds were found by the tens of thousands they are now rare, except in their protected breeding places. Had it not been for the efforts of the Audubon societies in securing protective laws and enforcing them, this bird would have become extinct.

This series of pictures shows the shameful way in which the beautiful Egrets were sacrificed to adorn women's hats, until the law put a stop to it. 1. Mother Egret on her nest. 2. Shot by a plume hunter! 3. Baby Egrets crying for food. 4. Almost gone. 5. Last stages of starvation.

The crane looks like the heron, but belongs to quite another order of birds, the "marsh-dwellers," or *Paludicolae*. Although the crane stands nearly as high as a man, it is closely related to the little rail, which belongs to the same order. The female lays her two spotted grayish-green eggs in a nest built upon tufts of marsh grass. Cranes feed principally on the vegetables and animal life of the swamp, though they have been known to plunder newly sown grain fields.

These birds are great travelers. They migrate from southern India to Lapland and from arctic America to the tropics. When setting out on their long journey they first make a great circling in the air, and finally form into two lines meeting at an angle. One of the oldest of the flock sets the pace, leading off with a trumpet-like call that may be heard even after the birds have risen above the clouds.

Cranes have long been considered to be weather prophets. When they fly high and quietly, it has been noted that fine weather continues, but when they fly low and are noisy, cloudy weather may be expected.

North America has three well-known species—the whooping, or great white crane, the little brown crane, and the sandhill crane—the last a large grayish bird common in the Mississippi valley.

The crowned crane of Africa has on its head a spreading tuft of feathers much larger than the head itself. The national crane of Japan, called the tancho is similar to the sandhill crane.

Scientific name of common European stork, *Ciconia alba;* adjutant stork, *Leptoptilus argala;* white ibis, *Guarana alba;* wood ibis, *Mycteria americana;* blue heron, *Ardea herodias;* green heron, *Ardea virescens;* common heron of Europe, *Ardea cinerea;* the egret, *Ardea egretta;* whooping crane, *Grus americana;* sandhill crane, *Grus mexicana.*

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Storms. Whenever the air in one place becomes warmer than the air surrounding it, it has a tendency to rise. That is because warm air is light, and cold air is heavy. The movement toward the "low," the place of lightness and warmth shown on the weather map (*see* Weather Bureau), causes winds, which blow in from all sides along curved lines. In the Northern Hemisphere these winds blow "counter-clockwise"—that is, just opposite to the way the hands move on a clock. In the Southern Hemisphere they move clockwise. The curving of the lines and the difference in direction are due to the curve and rotation of the earth's surface.

This inblowing of winds causes a whirl—such as anyone may see on a warm day in a dusty place. These whirls may be a few inches or miles—even up to a thousand miles—in diameter. Hurricanes, tornadoes, typhoons, cyclones, cyclonic storms, are some of the names applied to them according to their nature, size, and the region in which they appear. All these various forms of storms can be classified under the headings tropical cyclones, temperate zone cyclones, thunder-showers, and tornadoes.

The tropical cyclone is called a hurricane in the West Indies, a typhoon in Chinese waters, and a baguio in the Philippines. Joseph Conrad, the sailor-novelist, has a remarkable account of such a storm in his story called 'Typhoon'. Sailors always know when one is approaching by these signs: there is a thin haze of curious clouds which cause dull red sunsets; the air is sticky and hot; the barometer shows unexpected high pressure, and the wind dies down; there are long rolling swells on the sea; and soon after the barometer falls, and continues to fall. Then a rain cloud appears on the horizon, rushes on the ship, and lets fall such a deluge that the air seems made of water. The wind increases steadily until it blows as high as 100 miles an hour or more. The ship struggles on, until suddenly the wind dies down, blue sky appears, and all seems serene. The wary sailor knows, however, that he has passed through only one-half of his troubles. Suddenly the wind rises from the opposite direction and blows sometimes with even greater fury. After a few hours, the wind ceases and the heavens gradually clear. What has happened is that the ship has been through the eye, or center, of the storm, and has caught the violent winds which blow toward it on both sides.

Havoc Wrought by Tropic Cyclones

These tropical cyclones are very destructive to shipping, agriculture, and buildings on the coasts. They cause waves which sometimes flood cities with great loss of life, as at Galveston, Texas. Usually such storms when they arise in the region of the West Indies, curve off to the northeast across the Atlantic, but they occasionally change their direction and bring great havoc to the southern parts of the United States.

The temperate zone cyclones, usually called cyclonic storms, are far less destructive; indeed, we are usually in some part of one almost every day. While they, too, are great whirls, and have "lows" toward which the air blows, they move more slowly and are characterized by gentler winds and rains. The tropical cyclones are rarely more than 600 miles across, while the cyclonic storms may extend across a region of 1,000 miles or more. The tropical storm loses its force as it travels into temperate regions or over large land areas; the other may suddenly increase in vigor. These cyclonic storms sometimes travel all the way around the earth, and other times they do not get far from their point of origin. They are of great importance to crops, because they bring alternate days of rain and sunshine. They are more common in the Northern than in the Southern Hemisphere. Many reasons for their formation have been suggested, but no one is really sure what starts these huge eddies in the atmosphere.

Thunder-showers are caused by moist air rising, cooling, and condensing its moisture. The most common kind is the hot afternoon storm, when the towering clouds build themselves into masses that rise in billowing curves above a flat base, and get darker and heavier with moisture, as they rise higher and higher (*see* Clouds).

Everyone has watched the various stages of a thunder-shower, the heavy nimbus cloud, the descending rain, the squall caused by the rising and sinking air at the front of the cloud, forming a whirl, and the broken clouds following after. Lightning, thunder, and hail accompany these storms as a general thing. In the tropics it is common for regions to have 200 such storms during the year, or rather to have 200 days recorded as having thunder-showers. The number is decidedly lower in the United States. New Orleans may have 70 such days in a year, while Boston may have as few as 16. The path of a thunder-shower is far shorter and narrower than that of a hurricane or cyclonic storm, and its duration is usually only for a few hours.

The Tornadoes and Their Ways

Tornadoes, often called "cyclones," usually occur as parts of thunderstorms. For some reason an eddy is started which makes a funnel-shaped cloud moving toward the east with the larger storm of which it is a part. By centrifugal force the air is thrown away from the center of the whirl, thus leaving an area of low pressure. Houses sometimes collapse and roofs are carried off because of the very great difference of pressure within the tornado and outside of it. Very queer feats are sometimes performed by these tornadoes. Corks are drawn from bottles, window panes explode outward, straws are driven through boards, babies and even cattle are sometimes carried as much as a mile. The destruction is terrific, but fortunately the path of a tornado is never very wide, varying from a few feet to several thousand. The noise they make is so great that everything in the world seems to be a part of one great roar. The lightning in the funnel is so constant that it seems dull red in color at times. Such tornadoes or "cyclones" are peculiar to the

United States, and indeed to the open prairie country, Kansas having the reputation of being the real "cyclone" state.

STORY-TELLING. "Mother, tell me about when you were a little girl." Nine out of ten children ask that, and ask it over and over again! Right in that interest are the guides for use in telling all stories to children.

They have many reasons for liking to hear the stories of mother's "little-girl time." In the first place, most mothers tell stories of their own experiences more realistically and interestingly than stories which they have read. So here is guide number one in telling a story to children: Make it so *real* to yourself by careful thoughtful reading and familiarity with every detail that you can give it to the children as if you had lived it. Children's memory for detail is remarkable, and if you call the hero of the story "John" on Monday, and "Robert" on Wednesday, you are sure to be corrected, and in the interruption much of the charm of the story is lost. Such mistakes in detail strike a child as unfavorably as a false note in your favorite song, or a wrong line in your favorite poem, so, first of all, make the story yours before you try to tell it to the children.

The Plot Should Be Very Simple

The second reason children, especially young children, are fond of stories of mother's childhood is that one character takes the center of the stage and the plots are simple. Young children are not able to follow the adventures of more than one or two characters at a time, and these adventures must be short and dramatic. To three- or four-year-old children the story of how mother, when she was a little girl, went to the grocery store, met a cow and ran home again, is a thrilling adventure, with enough drama in it to hold them spellbound. So here is guide number two for little children: Select stories that preferably have one, and not more than two characters, that are short and simple in plot, and tell them dramatically.

The third reason for the preference for mother's personal experiences comes from the fact that they are "really true." For the same reason, stories from history are fascinating to children. The heroes were real men, who fought and rode and accomplished things. Nature stories are real, and can be made as interesting and dramatic as any fairy tale. True stories furnish the best possible means to lead an over-imaginative child into the world of realities. If they are told well, he gradually comes to see that just as thrilling adventures and strange things can happen in everyday life as he could possibly dream in his fairy-tale head. For such a child, stories of everyday heroes—firemen, policemen, engineers, steel-workers—are all good. The matter-of-fact child needs the opposite sort of story—plenty of fairy tales, mythology, and imaginative poetry to train his brain in dreaming a little.

The educational value of wise story-telling is almost unlimited. Faults may be corrected by them, desirable traits developed.

Another reason children want the stories of your own experiences is that you, unconsciously perhaps, put a great deal of enthusiasm into telling them. It is fun for you to remember the funny things that happened to you when you were a little girl. You really feel the tragedy of the time a boy broke your favorite doll; you actually enjoy the memory of the Sunday-school picnic when you took the first cake you ever baked. All this joy and sorrow and enthusiasm you give to the children. Do the same thing with all stories. Enjoy the humor of the funny story, really feel sorry for the mishaps of the characters, whether they are knights, or small girls, or only animals. Have the same pride over the winning of the skating match by the boy in the story as you do over the triumph of your own first cake. It isn't hard to do this if you forget you are a grown-up and pretend you are just the age of your audience.

And now we have the main rules for successful story-telling. The next thing, is *what stories to tell:* and after that, *where to find them.* For books of stories are much like the eggs which the country storekeeper advertised: "Good—Extra Good—Real Good."

For children of all ages select stories with plenty of action, simplicity of plot, few characters. For little children choose stories which repeat over and over the same words. You will find these classed as "rhythmic stories" in books on story-telling. The 'Three Bears', 'Chicken Little', 'Three Billy-Goats Gruff', 'Three Little Pigs', are good examples. For children from six to ten, stories of adventure, fairy tales, nature myths, historical stories, Indian and hero stories are great favorites; and lessons of honor, bravery, and loyalty can be taught through them.

Some Useful Books

The following books, in addition to those mentioned in the article Literature for Children, will be found helpful to a mother in search of material and suggestions for story-telling:

'Some Books on Story Telling', by R. T. Wyche.
'Stories to Tell to Children', by Sara Cone Bryant.
'How to Tell Stories to Children', by Sara Cone Bryant.
'Story Telling, What to Tell and How to Tell It', by Edna Lyman.
'List of Good Stories to Tell Children under Twelve', Carnegie Library of Pittsburgh (five cents postpaid).
'The Golden Windows', by Laura E. Richards.
'Book of Nature Myths', by Florence Holbrook.
'Magic Casements', by Kate Douglas Wiggin.
'The Story Hour', by Kate Douglas Wiggin and Nora Archibald Smith.
'English Fairy Tales', by Joseph Jacobs.
'Norse Fairy Tales', by Joseph Jacobs.
'Celtic Fairy Tales', by Joseph Jacobs.
'Indian Fairy Tales', by Joseph Jacobs.
'Arabian Nights Entertainments', by Andrew Lang.
'Old Greek Folk Stories', by Josephine Preston Peabody.
'The Boys' King Arthur', by Sidney Lanier.
'Nights with Uncle Remus', by Joel Chandler Harris.
'Just-So Stories', by Rudyard Kipling.
'Among the Farmyard People', by Clara D. Pierson.
'Among the Night People', by Clara D. Pierson.
'Among the Meadow People', by Clara D. Pierson
'Fifty Famous Stories', by James Baldwin.

contained in the Easy Reference Fact-Index at the end of this work

'Thirty More Famous Stories', by James Baldwin.
'Merry Adventures of Robin Hood', by Howard Pyle.
'King Arthur and His Noble Knights', by Macleod.
'Lives of Poor Men who Became Famous', by Sarah T. Bolton.
'Famous Leaders among Men', by Sarah T. Bolton.
'Popular Tales from the Norse', by Dasent.
'East of the Sun and West of the Moon', by Gudrun Thorne-Thomsen.
'Indian Stories Retold from St. Nicholas'.

Stoves and Fireplaces. Although fires for cooking and warming have been used from the dawn of history, the invention of the closed stove did not take place until modern times. Even chimneys to supply a draft and lead the smoke and fumes out of the house were unknown until the 12th century. The ancient Greeks and Romans warmed their homes chiefly by charcoal fires in open braziers or chafing dishes. When fires were built indoors, on a slab of stone, it was customary to leave an opening in the roof above, through which the smoke might escape. In cottages in the Middle Ages the door was often made in two sections, so that the lower might be closed to keep out the chickens and pigs, while the upper half was swung open to let out the smoke.

In Holland, Russia, Germany, and other northern countries of Europe, closed stoves of brick or porcelain tile have been in use since the end of the Middle Ages. These are great high structures, made with a small fire-box in the bottom and a series of winding passages above through which the heated smoke is conveyed. The tiles retain their heat for many hours, and a small quantity of wood, coal or pressed briquets of coal dust will keep a room moderately warm all day.

The early colonists of America did most of their cooking in open fireplaces, with swinging cranes on which to hang the pots. Brick ovens were used for baking. A fire was built inside these and then raked out and the bread or roast was put inside and baked by the heat of the bricks. They also used a simple "Dutch oven," which consists of an iron skillet set on legs amid the coals, with live coals heaped also on the lid with which it was covered.

A revolution in the art of heating was begun by Benjamin Franklin, when in 1744 he invented the portable fireplace of iron, which could be set out in the room away from the chimney, and thus yield far more heat than the old style fireplace. A modification of Franklin's iron fireplace, known as the "Franklin stove," is still in use in many parts of the United States. This has sliding doors in front, so that the fire may be either closed or open. In the course of time Franklin's stove was modified into the familiar box cooking-stove or range, with its oven below and pot-holes in the top. For heating purposes only, Franklin's stove developed along other lines, finally producing the base-burning magazine stoves familiar in many homes. Cast-iron stoves were known in Alsace, as early as 1490, it is said, but they did not then come into general use.

The great advantage which stoves have over fireplaces is that they make use of 75 per cent or more of the heat value of the coal, while in fireplaces only about 12 per cent is used; the rest escapes up the chimney. Fireplaces, furthermore, do not directly warm the air. The rays of heat pass through the air like light rays and do not give off their heat until they fall on the floor and walls and furniture. Thus it takes much longer to warm a room with an open fire than with a stove, which warms the air directly.

Just as stoves superseded fireplaces, so stoves, both for cooking and heating, are giving way to modern heating systems—hot air, steam, and hot water—and to gas ranges. In cities nearly all houses and apartments have a central heating plant, and gas is generally used for cooking, because of its convenience and cleanliness. (*See* Heating and Ventilation.)

Stowe, Harriet Beecher (1811–1896). The distinction of having written the book which had a more direct and powerful influence upon the history of her country than any other piece of literature belongs to Harriet Beecher Stowe, the author of 'Uncle Tom's Cabin'. By its vivid pictures of suffering and oppression this novel aroused the people of the North against the evils of slavery, and thus is reckoned as one of the forces which helped to bring about the Civil War.

Mrs. Stowe, who was born at Litchfield, Conn., belonged to the famous Beecher family, being the daughter of Dr. Lyman Beecher and the sister of Henry Ward Beecher, both of them famous preachers. When Dr. Beecher became president of Lane Theological Seminary, at Cincinnati, the family moved to that city. There she married Calvin E. Stowe, a professor in the same institution. Only the Ohio River separated them from slave territory and in the 18 years which Mrs. Stowe spent in Cincinnati she had many opportunities to observe and study the slavery problem. She and her friends aided many slaves who had escaped across the river, and from the lips of these fugitives she learned of the terrible treatment they had suffered. In 1850 she went with her husband to Brunswick, Me., where he became a professor in Bowdoin College. In this quiet town, far removed from any painful scenes, she wrote her 'Uncle Tom's Cabin', or 'Life among the Lowly', which first appeared serially in *The National Era*, an anti-slavery paper of Washington, D.C., and was published in book form in 1852.

'Uncle Tom's Cabin' was hastily written and it gives a one-sided picture of slavery; in spite of this it is a great novel, and after many years has not lost its power to touch the heart. It has been translated into more than 20 languages. In dramatic form it has been produced on the stage countless times, and it has also been presented in motion pictures.

"Uncle Tom" was modelled upon a negro slave named Josiah Henson who in 1828 escaped into Canada and became a Methodist preacher. He made many lecture tours in America and England in later life.

Among Mrs. Stowe's other works are: 'The Mayflower' (1843), a collection of tales and sketches; 'Dred: A Tale of the Dismal Swamp' (1856); 'The Minister's Wooing' (1859).

STRATFORD-ON-AVON, ENGLAND. Probably no town in the world lives so completely on the memory of one famous man as the English town of Stratford on the Avon River, the home of Shakespeare. It is estimated that 30,000 people, one quarter of them Americans, visit Stratford every year.

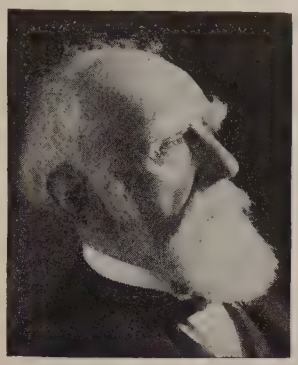
In this ancient Warwickshire town, 93 miles northwest of London, Shakespeare was born, and here he died. Both he and Anne Hathaway, his wife, lie buried in the church of the Holy Trinity. On the slab over his grave is the famous inscription, said to have been selected by Shakespeare himself:

Good friend, for Jesus' sake forbeare
To digg the dust encloased heare;
Bleste be ye man that spares thes stones,
And curst be he that moves my bones.

The house of Shakespeare's parents, which contains the small whitewashed room in which he was born is still preserved. (For picture, *see* Shakespeare.) On the walls of this room appear innumerable signatures of distinguished visitors, among them the names of Walter Scott, Thackeray, and Dickens. The house serves in part as a museum of Shakespearean relics. The little thatched cottage in which Anne Hathaway was born at Shottery, about a mile from Stratford, is also a museum. At Wilmcote, near by, is the cottage of Shakespeare's mother, Mary Arden.

A Shakespeare Memorial building has been erected in Stratford, including a theater, a gallery of paintings, and a library of his books. The Harvard House, belonging to Harvard University, was the home of the mother of John Harvard, the university's founder. American visitors have presented to the Holy Trinity Church a stained glass window commemorating Shakespeare's poetry, and to the town a memorial fountain and clock tower.

Removed from the rush of modern industry, Stratford remains today the same pleasant, peaceful little town, with wide streets and quaint half-timbered houses, that it was in Shakespeare's day. Population, about 10,000.



LORD STRATHCONA
"Grand Old Man of Canada"

STRATHCONA, LORD (1820–1914). "The grand old man of Canada," as he was called in the later years of his long and brilliant career—the man to whom in large measure western Canada owes its splendid and rapid economic development—was born in a little stone cottage in the town of Forres, Scotland, and was christened plain Donald Alexander Smith. The story of how he rose from poverty to wealth, of the part he played in transforming a wilderness into a great country, and in joining the Atlantic and Pacific by the great Canadian Pacific Railway, of how through his own great achievements he became Sir Donald A. Smith, and finally Baron Strathcona and Mount Royal, reads like a romance.

Before he was quite 18, this sturdy Scotch lad left his simple home to seek his fortune in the New World. He entered the service of the Hudson's Bay Company, which at that time controlled most of what is now the Dominion of Canada. For 13 years he roughed it in the dreary wilds of Labrador and was the first to prove that potatoes and other vegetables would grow on that bleak coast. Then he spent ten years more in the Canadian Northwest. He mastered the fur trade, he found time to read and study, and promotion followed promotion until he became the resident governor of the company, with headquarters in Montreal.

Fur traders, Indians, and half-breeds all respected and trusted Donald Smith. So when the rebellion under Louis Riel broke out on the Red River in 1869, the Canadian government appointed him special commissioner to deal with the rebels, and to his tact was largely due the bloodless suppression of the uprising. When in 1870 the province of Manitoba was organized, he was elected to its first legislative assembly, and for many years he was a member of the Canadian House of Commons.

A man of understanding and vision, he saw that if Canada was to become a great country, if the distant parts of this vast territory were to be knit to the center, it must have a trans-continental railroad. It was largely through his financial and administrative ability, and the use of his own fortune, that the Canadian Pacific Railway was completed in 1885.

Of the vast wealth which came to him from this railroad and other sources, he gave millions to McGill University, to Victoria College for Women at Montreal, to Royal Victoria Hospital, and to many other institutions. His most unusual gift, however, was made to the British government during the Boer War, when he raised and equipped at his own expense a regiment of cavalry known as Strathcona's Horse.

Donald Smith was knighted by Queen Victoria in 1886, and in 1897 he was made a baron with the titles Strathcona and Mount Royal. In 1896 he was appointed Canadian Lord High Commissioner in London, and from that time until his death, in his 94th year, he was one of the most prominent figures in public life of the British capital. Few men did more than he to strengthen the bonds between Canada and the British Empire.

STRAUSS, (*strous*), **RICHARD** (born 1864). The most talked of musician of the early 20th century was Richard Strauss, for in most of his compositions for orchestra he cared little for beautiful melodies, but rather tried to make his musical picture real. To do this he did not hesitate to employ the most repellently discordant tone combinations, and to use the instruments of the orchestra to produce extraordinary imitative effects. Thus the hissing of steam is produced by rubbing a drum-head with coarse brushes; the trampling of horses' feet by means of a Chinese wooden drum beaten with tubular sticks; the plashing

of rain is imitated by means of a drum filled with small stones mounted upon bearings and rotated.

Richard Strauss was born at Munich, Bavaria. His father was one of the greatest horn players of Germany and Richard early showed signs of musical talent. At four years he played the piano well, at six he was composing, and at ten he was seriously studying. Up to 1890 his compositions were not unusual, and he was known chiefly through his position as conductor of the Munich opera, rather than as a composer. From this time on, his compositions became distinctive for their radical innovations. Storms of criticism, ridicule, and abuse followed the appearance of each new work. However, time and familiarity have done much to reconcile the public to his methods and his place is now among the foremost composers and conductors of the day. In 1898 he settled in Berlin as conductor of the Royal Opera.

Of Strauss's operas, 'Salome' has probably been the most discussed, and his 'Rosencavalier' the most liked. His symphonic poems have given rise to violent discussion for and against, but his songs, because of their unfailing melodic beauty and delicate charm, have been universally accepted and have given Strauss rank as one of the great lyric masters.

STRAWBERRY. "Doubtless God could have made a better berry, but doubtless God never did." This is Izaak Walton's tribute to the strawberry in the 'Compleat Angler'. Whether you eat the wild strawberry, with its piquant flavor stored in a drop of red no larger than the tip of your little finger, or the great delicious berries, nearly as large as your fist, that are developed under cultivation in England, you agree that the strawberry is worthy of such praise. It is called the "rose among fruits," for its brilliant red is as attractive as any flower and its fragrance is as inviting.

Fortunately our favorite has been developed in many varieties adapted to a wider range of conditions than any of the other small fruits. The strawberry season opens in Florida and other Southern states in February and moves northward to Canada, where it closes in July. Trainloads of fruit leave each day from the principal strawberry sections of the country as the plants come into the height of their bearing, and choice varieties are forced in greenhouses to supply strawberries out of season at fancy prices. Fresh strawberries from the home garden may be enjoyed during a long season if both early and late varieties are grown, or the perpetual or ever-bearing strawberry which bears all through the season.

In view of the fact that about 1,000 varieties of strawberries are grown in the United States today, it is surprising to learn that as late as the middle of the 19th century there were no strawberries in the city markets and few cultivated strawberry beds. Strawberries grow wild all through the North Temperate Zone and in the Andes region of South America, but little progress was made in their cultivation until a Chilean berry taken to England developed into a superior variety. Improved English varieties were later brought into the United States, but not until the Wilson berry appeared about 1840 was there a variety that could be depended upon for growth in every garden. Some of the earlier failures were due to the fact that certain kinds do not bear perfect fruit because their flowers do not produce sufficient pollen. Today varieties that are good pollen-bearers are always planted with such varieties to insure success.

A bed of strawberries is seldom kept in bearing more than a year or two. New plants may be obtained from seed, which are always depended upon for developing new varieties, and from the division of the plant head; but the usual method is to use the new plants set from runners. These are placed in rows or hills on rich well-cultivated ground. After cultivation is discontinued, and usually after the bearing season, the numerous runners loop out from the parent plant and root new plants where they touch the ground.

The strawberry belongs to the genus *Fragaria*, a name meaning fragrance. The "berry" is botanically not a berry at all, but an enlarged pulpy receptacle in which the very small seed-like *achenia* (the true fruits) are embedded.

STREET RAILWAYS. If the rails in the street railways of the United States were laid in a continuous track, they would reach almost twice around the earth at the Equator. The number of rides on these railways, if evenly distributed among the people of the United States, would give everyone, from the fisherman on the coast of Maine to the lonely rider on the borderland of Mexico, about 115 rides a year. Everyone in the world, the Eskimos and the African savages counted in, could have six rides each year.

The electric lines would furnish 997 out of every 1,000 miles of that track around the earth. Over five billion dollars are invested in the electric street railways of the United States, which is more money than that employed in any other electrical industry. Electricity has taken the street railways, which at first were found only in the large cities, out into the villages and suburban communities; while the interurbans run between cities often a hundred miles or more apart, carrying freight as well as passengers.

In addition to the surface lines, some large cities have elevated lines held above the streets on steel structures, and subway lines running in tunnels underground. Elevated and subway trains make fewer stops than surface cars and run at speeds greater than is possible in surface traffic. They are practicable in territory that offers an abundance of "long haul" traffic, but owing to their high first cost they cannot be made to pay a return on the capital used in building them in territory where traffic is light except during certain "rush hours."

This great network of city and country, surface, elevated, and subway lines had its small beginning in 1832 when the first street-car, drawn by a team of horses, passed along the streets of New York City. Nearly 30 years later the first street railway in Europe was built in Birkenhead, England, by an American.

These early street-cars did not look much like our modern ones. They were simply coaches drawn by horses on a flat rail track. But on these tracks they could go so much faster and with so much heavier loads than coaches drawn over rough pavement that everyone became excited when first seeing them, and people cheered as the cars sped by. Some, we are told, were afraid to ride on such "fast" cars.

The Cable System

People learn quickly, however, and soon the horses couldn't go fast enough to suit them. So they began to try other means, such as compressed air motors, the moving cable, and the electric motor. Of these types, the cable railway at first proved best. A continuous wire cable running in an underground conduit between the tracks was kept in motion by a stationary steam engine placed in the power house at the end of the line. An arm on the street-car reached down through a slot into the conduit and gripped the cable when the car was to be pulled along, releasing it when a stop was to be made. Cable lines are still used over unusually hilly routes, where a self-driven car could not get sufficient grip on smooth rails to keep it from sliding back down hill.

The first electric motor to operate a car was probably one exhibited by Thomas Davenport, a blacksmith of Brandon, Vt., in 1835. But this car, as well as other early electric cars tried out in the United States and Europe, was operated by a storage battery, making it too expensive for general use. It was not until the invention of the dynamo made electric current abundant and cheap that it could be applied to street cars. The success of the electric street railway built in Richmond, Va., in 1888 by F. J. Sprague, by proving the new method practicable, established the supremacy of the electric street-car for city traffic. Twenty-five years later there were 1,000 electric railway systems in the United States. Only nine roads used animal power, the longest of these being three miles long. Eight roads used gasoline motors, and 21 used cable traction; but 11 of these were inclined-plane roads carrying tourists up the mountains.

The Modern Street-Car System

Most electric street-car systems are the same in their essential features. First of all, there are the dynamos which furnish the necessary power. In most systems the current goes out along heavy "feeder" cables, which are connected at intervals to the overhead trolley wires. A metal arm on top of the car presses a small wheel against this wire, and provides a path down which the current can run to the motors beneath the car. From the motors it runs through the car wheels to the rails, and back along the rails and through the earth to the dynamo. A "control" inserted in the circuit between the trolley arm and the motors regulates the application of power.

This general system is modified in several ways in many cities. The return current often leaves the rails, travels along water and gas mains and damages them (*see* Electrolysis), so some cities require the use of a second trolley-wire for the return current. In other cities, where the expense can be met and the danger from overhead trolleys is great enough to warrant the cost, a conduit system is used. In this a conduit with an open slot at the top is built between the tracks. The wire carrying the current from the dynamo is placed in this conduit, and an arm from the car enters the slot to draw current for the motors.

The motorman's control mechanism consists essentially of a huge rheostat switch placed in an upright metal box. The switch contains a number of "resistance circuits" and by turning the control lever he can divide the current between these resistances and the motors in various proportions. The more current he sends to the motors, the faster the car goes, up to full speed. The control also contains a switch for reversing the direction of the current, which reverses the direction of travel.

Most cars are provided with air-brakes and a hand brake for use if the air system should fail. Perhaps you have noticed the throbbing sound that comes at times from beneath street cars. This is the pump which maintains the proper pressure for the air-brakes, and it starts going automatically whenever the pressure falls below a certain point (*see* Brakes). All of the motions necessary to controlling the car are made as simple as possible so that the motorman can give his attention to watching the cross traffic and other conditions affecting the operating of his car.

Improvements Made in Recent Years

Most of the recent improvements in street-cars, except for details and increased size, have been in the motors and power lines. In earlier lines, direct current under pressure not exceeding 600 volts was used (*see* Electricity). But when huge hydro-electric plants offered cheaper power than steam power plants could produce, changes became necessary. The hydro-electric plants furnished high-voltage alternating current, because it could be transmitted long distances with less loss than direct current, and electrical engineers busied themselves in applying this current to street-cars and interurban railways.

One of the first systems employed sub-stations at various points along the car lines. These sub-stations converted the high-voltage alternating current to low-pressure direct current by means of "rotary converters," and fed the new current to the trolley wires. Later, satisfactory alternating current motors were devised, and instead of expensive sub-stations it was only necessary to use transformers to reduce the current fed to the trolley wires to voltages between 3,000 and 15,000 with other transformers on the cars to reduce it further to voltages between 1,000 and 2,000 for the motors.

A valuable improvement for elevated and subway lines, where cars are used in trains, is the "multiple control." The next time you stand on an elevated or subway platform, watch the operation of a train of electric cars and see how it differs from that of a steam train. When the electric train starts, the wheels

begin to turn at the same time on all cars; while in the steam train the wheels of the locomotive turn first and impart their motion to the rest of the cars in turn. This is because there is duplicate equipment on each car, and through a device called the "multiple-unit control" the motorman, by moving the lever on the front car, controls the motors of all the cars at the same time.

Another useful development is the "third rail" system of supplying current. This system uses a rail placed at one side about a foot from the track and raised above it on supports. This exposed rail carries the current. To bring the current to the motor, a short arm reaches out from beneath the car and a metal block called a "shoe," or a metal brush, at the end of this arm slides along the third rail. This third rail system is used on elevated and subway lines, but it is too dangerous for surface street use.

The Blessing of the Interurban

The "interurban" line is essentially an extension of the street railway to connect nearby towns and provide electric transportation for country people along the route. In favorable territory, where the steam railroads are weak or local traffic is dense, interurban lines have developed an elaborate service, with dining and sleeping cars, but as a rule they are confined to that class of service which steam roads do not find it worth while to offer. They are a blessing to country regions, however, for they, with the automobile, have broken down the isolation in which the farmer was forced to live in former times, and placed city facilities and amusements within his reach. (For relations between street railway companies and the public authorities, *see* Public Utilities.)

STRYCHNINE (*strĭk'nĭn*). In the far East (India, Siam, Burma, Cochin-China, and Australia) grows a tree called by scientists *Strychnos nux-vomica*, which bears fruit like a small orange. This fruit has from one to five flat disklike seeds. The poisonous drug, nux vomica, made from these contains two alkaloids, strychnine and brucine. Strychnine, which is a poisonous white powder, is used in many vermin powders. Stories of frontier days often tell of their placing of carcasses poisoned with strychnine as baits for wolves. Strychnine is also used medicinally as it is a powerful heart stimulant. A South American variety of the Strychnos tree furnishes an intense poison, *curare*, which the natives use for poisoning their arrows and darts.

STUART. The name of a royal family of Scotland and England. Robert II (ruled 1371–1390), the son of Walter Steward and Marjory (daughter of Robert the Bruce), was the first Scottish ruler of the line. Robert III, James I, II, III, IV, V, and Mary followed him in succession. Mary Queen of Scots changed the spelling of the name to Stuart. James VI of Scotland, Mary's son, on the death of Queen Elizabeth became king of England as James I (1603–1625), thus uniting England and Scotland under one crown, though they remained independent in every other respect. Charles I (1625–1649) followed James I. The Stuart succession in England was interrupted by the Commonwealth, but was resumed at the Restoration with Charles II (1660–1685). The remaining rulers of the house were James II (1685–1688), his daughter Mary, who ruled jointly with her husband William III (1688–1702), and Anne (1702–1714), Mary's sister, who took the throne upon the death of William.

The SECRET *of* SUCCESSFUL STUDY

Both the Pleasure and Profit of Study Depend Much on How One Goes about It—What "Education" Really Means—The Kind of Knowledge That Is Power and How to Acquire It

STUDY. One's attitude toward study and toward school in general is greatly dependent on one's method of study. If there is friction in the process, one dislikes study and school and drops out of the latter early. But if little friction is present, so that the work is agreeable, one is likely to be a student and become well educated.

The problem is seen to be more serious still, when it is recalled that very young people study in such a way that they gradually lose their native energy to think and act independently. You can easily spend so much time collecting ideas of other people that you finally have no ideas of your own. Indeed, this tendency is common. Thus, in the very process of being educated the native self is undermined and weakened. The real object of study is not merely to collect a new mass of facts that can only submerge and destroy individuality. The object is to *use* facts and ideas as means of mental nourishment. They are the food by means of which mental and spiritual ability is developed, as meat and bread are the means by which the physical body is developed. A power of consumption of ideas, therefore, that insures good assimilation is of the highest importance to every young person.

What, then, are the precautions that should be taken to bring this about?

In the first place, something should be done to overcome the comparative helplessness characteristic of a large percentage of school children when they meet intellectual difficulties in their studies. The remedy for the evil is much greater initiative on the part of children during the recitation. So long as the recitation continues to be what it has usually been, i. e., a period when the teacher entirely assumes the initiative and the children are wholly followers, helplessness on the part of pupils must be expected. On the other hand,

if children are to become independent in mental work, they must be left alone more of the time, or at least must lead rather than follow in the recitation of lessons. This means that many of the recitation periods —possibly the greater part of those in the elementary school—should be spent by pupils not merely in reciting but in mastering lessons in the teacher's presence and under the influence of her suggestion. In other words, many of these recitation periods should rather be study periods, in which pupils study aloud before their teacher, thus taking the lead in such work and revealing their method of procedure for correction. This presupposes the teacher's willingness and ability to keep still much of the time—not altogether an easy task—and also a change of aim for much of the school work. Ordinarily that object is knowledge of the various studies; in such work as is here suggested, however, it would be knowledge of how to study, which is a very different thing.

Teachers may be willing to practice silence in class and to accept development of initiative on the part of their pupils as a very prominent aim. But until the children themselves become clear in regard to the direction in which initiative is to be exercised, they are likely themselves to be provokingly silent. What, then, are the further principal factors in proper methods of study?

Mistaken Ideas about Memorizing

Both children and college students generally recognize two main factors in study—memorizing and thinking. Which should come first? is the next important question to be met. Custom says: "Memorizing; fix the facts or thoughts in memory, then reflection upon them can follow at leisure." But there are always more duties in life than time allows us to perform, so that reflection is habitually postponed, until it is omitted. In consequence, to the great majority of persons studying signifies mainly the stultifying work of memorizing. Suppose, now, this order were inverted, and young people were taught to undertake first whatever thinking was expected of them in each lesson. They would then at least make sure of the more interesting part. But more than that, thinking thoughts through in the various ways required in good study is the very best method of memorizing them, and psychologists recommend this method even in the case of work to be committed to memory. Conscious effort to memorize would then be largely or wholly unnecessary, because the memorizing would become a by-product of thinking instead of a substitute for it. Here is a very important fact to be taught to young people about how to study. If it were applied there would need to be less of dull drill in school; one reason for so much of it now is that there is so little thinking. Some drill might still be necessary, but by coming *after* most of the thinking, the motive for it would be made plainer and it would be less wearisome.

What kinds of thinking are to be expected? is the next important question. In discussing the principal factors in study we naturally discuss the principal factors which we find to be involved in thinking.

First of all comes the selection of what is relatively most valuable. There is always a tendency for young people to regard ideas as all on the same plane of importance and many teachers encourage rather than overcome this tendency. It is encouraged by assigning lessons by pages, and then requiring practically everything to be reproduced in class. It is encouraged, also, by allowing facts to be reproduced in the order in which they have been presented in the text, since this method emphasizes again the importance of *everything*.

Recitation by Topics Rather Than by Pages

To combat this tendency it is well to require pupils or students to recite by topics or points, rather than by pages; to take up first what they consider the most important thought in the lesson, even though it happens to come last in the assignment; to suggest marginal headings and even write them into the margin, if the pupils own the books. By such means the habit of watching for the main issue or issues can be inculcated.

Directly connected with this should come training in the habit of overlooking or neglecting what is relatively unimportant. A pupil who has so good a memory that he reproduces practically everything in a lesson seldom deserves praise. Such a memory merely relieves him from the necessity of thinking enough to discriminate between what is especially valuable and what is insignificant. Some clearness as to the meaning of *thoroughness* in study is here involved. So long as young people are brought up with the idea that thoroughness means attention to everything, recognition of relative values will be wanting. A pupil should be now and then condemned, therefore, for paying attention to what is not worth the time. You cannot teach emphasis of some parts without presupposing neglect of others, for the two are correlatives.

The outcome of good training in these two directions should be a habit of seizing quickly on the main ideas presented, and of grouping the details bearing intimately upon them around the central thoughts. That would mean organization of thought, a most valuable factor in proper study. Not only should relative values thus always be very prominent in study, but the soundness, in final value, of ideas in life should also be considered. Many persons have a profound respect for print, and willingly hold as valuable whatever they find in a text. But from childhood on good judgment in this direction should be developed, and such attempts should be a part of a teacher's work, who is endeavoring to instruct pupils in the art of study. How often are newspaper and magazine articles, as well as whole books, unworthy of perusal! Young people must be trained, therefore, not only to judge what is relatively most valuable among a lot of ideas and facts, but what is valuable for life or lacking in such worth. In other words,

they must practice judging practical worth, must be made critical to this extent, and learn to believe in their right and ability in this direction. This is nothing more than saying that children and college students should develop independent judgment.

Applying Knowledge as One Goes Along

Intimately related to this last factor of study is the need of finding the specific bearings or relation that a given topic has for daily life. It is very common for students to store facts for distant future use, without reference to actual life at the present time. But that attitude is certainly wrong. Knowledge cannot be judged and digested till its relation to life is seen. The standard for passing judgment on values is found in life itself. Another way of expressing this thought is to say that the student should conceive specific purposes which the ideas he is studying along a given line are likely to further. This is by no means an easy task, but it is an important one. A person who habitually reads a book or magazine article without thought of any effect it may bring about, either in topics for conversation or journeys that he may take, hardly has the right method of study. This does not signify that one should never read for the "mere momentary tickle," or that he should always be strictly critical. But it does signify that the purpose of ideas is found in their expression, and that, unless one develop the habit of bringing what he learns to the point of its contact with life at home, on the street, and elsewhere, he is like the miser who hoards wealth without reference to its use. It is the wrong habit of mind for the student. Thus he should not only judge the value of thought, but should form the habit of using it.

Thinking is Better Than Reading.

Still another factor of study is the work of supplementing an author's statement. Even the best of authors fail to put most of their ideas into print; or as Ruskin puts it, all literature—like the story of the Prodigal Son—appears practically in the form of parables, requiring much supplementing in order to be properly pictured and interpreted. The words in a minister's text in comparison with those in his sermon are perhaps as one to a thousand. The statements in any textbook should bear a somewhat similar ratio to the thoughts that they suggest in the reader's mind. Accordingly, much time should be occupied by children in school in visualizing in greater detail and reflecting upon the scenes in geography, history, and other lessons. To this end, questions testing mainly memory are out of place; questions involving reflection should be common, if young people are to become reflective. Again the initiative, it should be remembered, should come from the children. A very common remark from the teacher in the treatment of any passage in a textbook might well be: "Do we need to stop here in order to talk over any matter?" The children should even learn to call a halt themselves at fitting places and offer the supplemental thoughts without suggestions.

These are some of the more important factors in proper study, very briefly presented. Children in the elementary school should be acquainted with these in their application, as they should be taught the principles of arithmetic. The teacher should always bear in mind that the main part or proper study is *reflection*—is *thinking* rather than memorizing. Someone has declared that the good reader spends at least as much time reflecting on what he reads as he does in the actual reading. That is a valuable suggestion. But if such a habit of study is to be brought about, the teacher must watch the character of her questions. The vast majority of questions put by teachers today are out-and-out memory questions, i.e., they tax memory primarily. In place of these must come thought questions. Then when children are told to "think and think hard," as they very often are, there will be some prospect that they will understand wherein consists the particular kind of thinking that is required of them.

STURGEON. Caviar and one of the best sorts of isinglass are two valuable contributions of the sturgeon to man. The former is prepared from the eggs (roe), which the female lays by the millions; and the latter is made from the inner membrane of the fish's swim-bladder. The flesh, though eaten fresh, makes much better food when smoked. It is an important article of commerce, and in the United States is valued especially by the foreign population of large cities.

The sturgeon is a large bulky fish with a long body, a skin covered with five rows of large bony plates, and a conical and tapering snout. There are about 25 species, which vary greatly in size. Specimens 8 to 11 feet long are by no means rare, while one species of the Black and Caspian seas reaches the enormous length of 24 feet and a weight of 2,000 pounds. On the other hand, some are rather small, such as the sterlet, which rarely exceeds a length of 3 feet. Most species live in the sea a great part of the year, ascending rivers to spawn, though a few, such as the sturgeon of the American Great Lakes, are exclusively confined to fresh water. Sturgeon are found only in the Northern Hemisphere and occur in greatest abundance in southern Russia, where the fisheries are of immense value. In the United States the chief fisheries are in the Delaware River and the Great Lakes. Most sturgeon belong to the genus *Acipenser*.

STUYVESANT (*stī'vĕ-sănt*), PETER (1592–1672). "A tough, sturdy, valiant, weather-beaten, mettlesome, obstinate, leathern-sided, lion-hearted, generous-spirited old governor"—this is the description given by Washington Irving in his 'Knickerbocker's History of New York' of Peter Stuyvesant, the last Dutch governor of New York—or "New Amsterdam," as it was then called.

Stuyvesant had served in the West Indies as governor of one of the islands, and for his good services there was appointed, in 1647, by the Dutch West India Company as the governor of their colony of

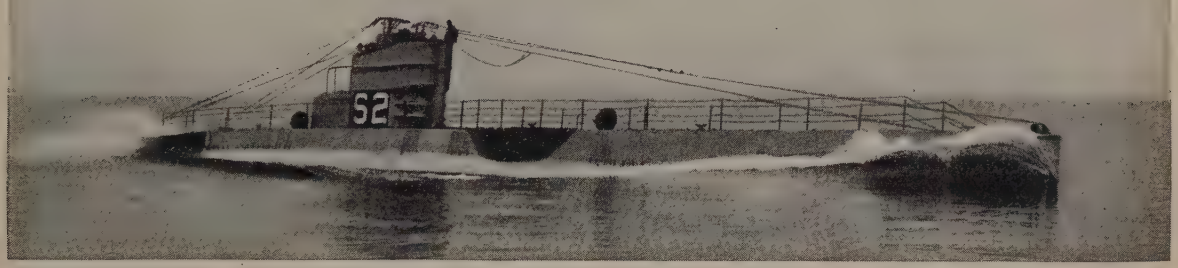
New Amsterdam. He had lost a leg in the service of the company in the West Indies, but his wooden leg has done more to preserve his fame in history than any other one thing. According to tradition, when the assembly of New Amsterdam went contrary to his wishes, he would stamp his wooden leg and roar at them.

Stuyvesant brought to his work a determination to be "as a father over his children," and he immediately set about trying to reform abuses with a commendable enthusiasm. His despotic character and his blunt manners, coupled with his efforts at reform, soon won him many enemies. He tried to regulate the sale of liquor, and forbade its being sold to the Indians at any time, but his orders were disregarded. He attempted to regulate the fur trade so as to give the inhabitants of New Amsterdam a monopoly of it, but smuggling became prevalent. His severity in punishing those who would not conform to the Dutch Reformed church, and his refusal to allow the people a share in the government, increased the hatred which most of the settlers felt toward him.

As a result of this trouble, when war arose between England and Holland and English warships appeared in New York harbor in 1664, although the city was defended by a stone fort and 20 cannon, the people refused to resist the invaders. So Stuyvesant was forced to surrender the town to the English, and New Amsterdam became New York.

Stuyvesant returned to Holland, but when the Dutch West India Company blamed him for all of their misfortunes in the New World he returned to America and spent the rest of his life on his farm, or "bouwerie," as it was called in Dutch. On the site of this farm now runs the street called after it the "Bowery," on the lower east side.

DEADLY CRAFT *that Travel* UNDER *the* SEA



SUBMARINE. For more than half a century delighted boys have followed the thrilling exploits of Captain Nemo in Jules Verne's 'Twenty Thousand Leagues under the Sea'. Overshadowed by this gorgeous fiction, the occasional attempts at producing a boat which could actually travel under water seemed trivial and tame.

Then came the World War. With the sinking of the British cruisers *Hogue*, *Cressy*, and *Aboukir*, in September 1914, the general public realized what naval authorities already knew, that the submarine —weak, slow, and blind as a mole in comparison with the proud dreadnoughts and battle cruisers—was an enemy to reckon with. With the sinking of the *Lusitania* and the *Falaba*, the horrified world awoke to the fact that this same submarine, in unscrupulous hands, was perhaps the deadliest sea weapon yet devised.

Captain Nemo's *Nautilus* was a true monster of the deep. The actual submarine, so called, is merely a "submersible"; it can swim under water, but for a limited time only—usually about 48 hours—and at a limited depth. With its periscope submerged it is almost entirely blind, and, so long as the boat is submerged enough to have to depend on the periscope, its vision is by no means equal to that of a surface craft. The size of its guns and the number of torpedoes it can carry are limited by the small size of the vessel. Its speed on the surface at the beginning of the war was about 15 miles and 8 or 10 submerged, as against 21 to 25 miles for a battleship, 25 to 30 for cruisers, and 35 to 40 for destroyers. Its one overwhelming advantage is its ability to become invisible at will—to fight when conditions are in its favor and to escape unseen when they are not.

What a Submarine Looks Like

A spindle or cigar-shaped craft about 230 feet long, 21 feet beam, and about 12 feet draft, with a little hump of a conning tower and bridge on top, and a signal mast and one or two periscopes standing up above that—such is, roughly, the outer aspect of an 800-ton submarine. The hull may be single or double. In the latter case, the space between the hulls is used for fuel and ballast tanks, which help to protect the inner hull from shells, torpedoes, or other source of harm.

On the surface most submarines are driven by internal combustion (Diesel) engines burning heavy oil, for gasoline fumes are too dangerous in the confined spaces of the hull. But this admirable engine

cannot be used when the vessel is submerged, because of the vast amount of air required for its consumption. Below the surface, an electric engine, which needs no air to breathe, is used instead. The batteries in recent types are charged by the Diesel engine while at the surface. One reason that the submarine cannot run under water for an indefinite time is that it must come to the surface to recharge the batteries. It is said the German U-boats (from *Untersee*, meaning "submarine") did not average three hours a day below the surface.

The submarine dives by letting sea water into the ballast tanks; it rises by blowing the water out of the tanks with compressed air, stored in seamless steel flasks at pressures of 1,000 and 2,500 pounds a square inch. The distribution of these water-ballast tanks, so that the boat will run on an even keel, whether submerged, awash (that is, with only the conning tower exposed), or on the surface, is exceedingly important. In the German U-boat, in addition to the ballast tanks distributed around between the inner and outer hulls, there are two inner ballast tanks amidships. The fuel-oil tanks have holes in the bottom to admit water as the oil is used up. The heavy lead keel can be dropped off in case of accident beneath the water, to bring the boat to the surface.

How the Submarine Keeps at a Given Depth

In order to remain at any given depth, the submarine must keep moving; it cannot hang suspended and motionless between the waves and the sand. To run below the surface, it usually takes on just enough ballast to leave it a little lighter than the water it displaces, and then runs with its horizontal rudders or hydroplanes tilted to hold it down. If its engines should break down under water, it must go to the bottom or to the top. If an enemy is hovering near, it may be preferable to drop down to the bottom and lie quiet—that is, unless the water is so deep that the pressure would crush the fragile hull.

To withstand the pressure of the water at the depths to which it may venture, the inner hull of the vessel is circular and very heavy and strong. As the outer hull has no air spaces, the pressure is the same within and without. It is therefore made of lighter material and so shaped as to keep the vessel steady when running on the surface.

The steersman may stand on the bridge when the vessel is running on the surface; in the conning tower, with its thick glass sighting ports, when slightly submerged or when seas are high; or in the central station or operating compartment down in the depths of the craft, viewing the surface only through the periscope, when submerged. There are usually at least two periscopes; this provides against accident and permits steersman and commander to use them at the same time.

The periscope tube, about 6 inches in diameter, stands from 15 to 20 feet above the top of the conning tower. It can turn in any direction, and is sometimes used to give a wider range of vision when the vessel is on the surface. The little tube itself is inconspicuous enough when the vessel is submerged, but it leaves a very suspicious-looking wake behind it. To run blind and then bob up for a view might mean a collision; so periscopes have been devised with a reduced diameter of two or three inches at the upper end, and also collapsing periscopes, which can be raised by a hand lever for a moment's view and then dropped down out of sight. (*See* Periscope.)

The submarine's guns were at first so mounted as to be depressed on hinges into deck housings when the boat submerged. Later German guns were rigidly mounted and left in place, being coated with grease as a protection against rust, and covered with a metal casing to decrease propulsion resistance.

How the Deadly Torpedoes are Fired

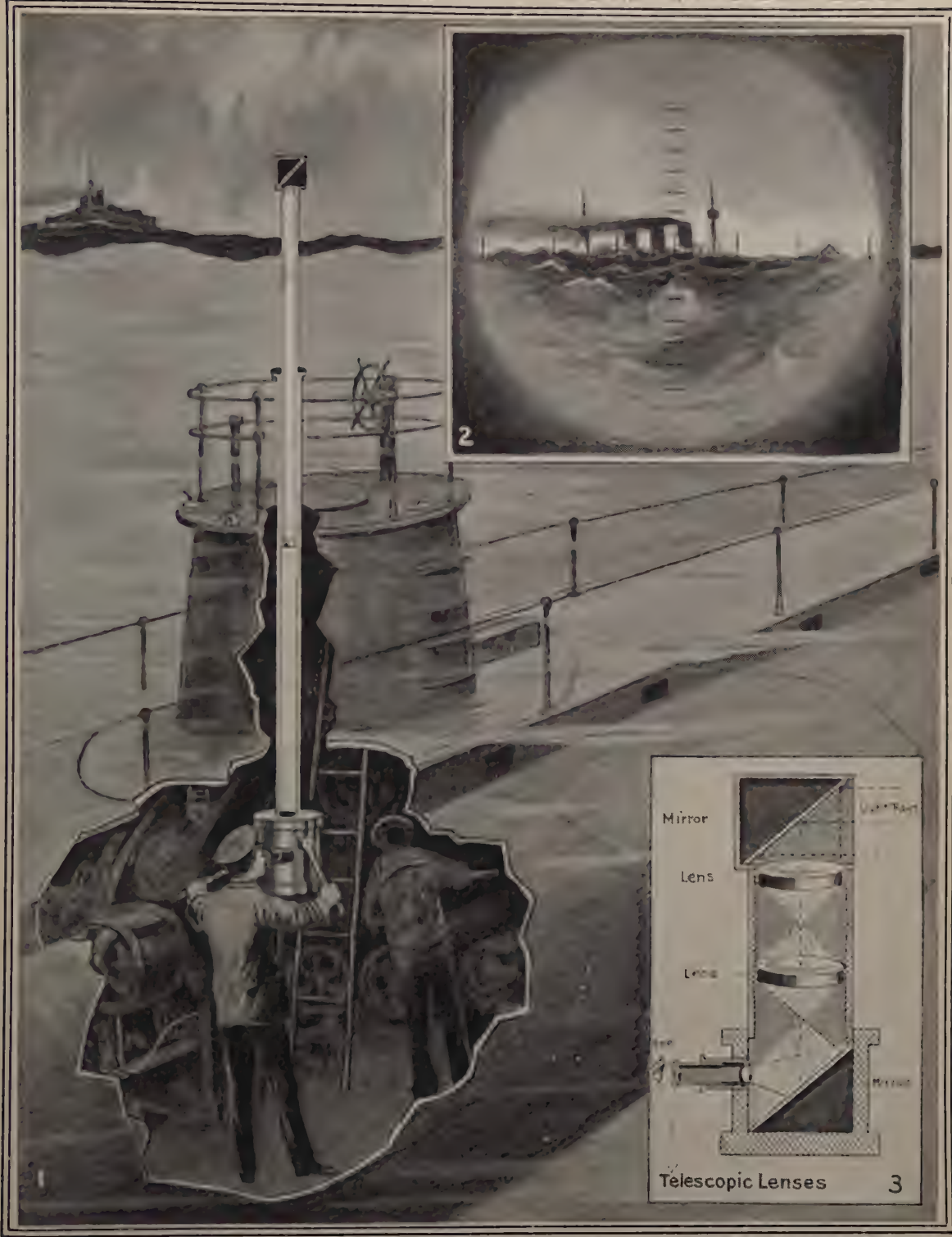
The torpedoes are fired from torpedo tubes by compressed air. Since the discharge of a heavy missile like a torpedo would upset the balance of the boat unless immediately compensated, torpedo-trimming tanks are located near the torpedo tubes. The early submarines carried two torpedo tubes; later models have four, two in the stern and two in the bow. Some British submarines also carry broadside torpedo tubes; still others have additional tubes on the superstructure.

Living quarters for three or more officers are ordinarily installed amidships and folding bunks for 20 to 40 men forward. All this, together with the auxiliary machinery, crowds the little hull almost to bursting. Small men are therefore preferred for submarine duty during a war. What with the cold, the heat, the stifling air when submerged, the whole cramped unnatural life—not to speak of the nerve-racking terrors when the submarine becomes the hunted instead of the hunter— existence on board an undersea vessel is not exactly ideal.

Captain Nemo's favorite amusement was ramming his enemies. That is no game for the frail submarine to play; it is more likely to be rammed itself. Guns and torpedoes are its weapons, with guns for choice if the enemy is unable to offer resistance. In order to use its guns, however, a submarine must present itself as target, with excellent chances of being sent below if the adversary is armed. Torpedoes, on the other hand, cost about $8,000 apiece, and it would be shocking extravagance to use one on a vessel known to be unarmed, or one so far away that there is no certainty of hitting it. So the German U-boats had orders not to fire a torpedo at a greater distance than 300 yards unless the conditions were particularly favorable.

A submarine's torpedo, exploding in the vitals of a battleship, is usually fatal, and the Germans expected to weaken the British fleet thus "by attrition" until their own fleet could engage it successfully. The U-boats did account for more battleships than did any other German craft, yet they never materially weakened the Allied fleet, because it was constantly escorted and screened by a type of fighting vessel which is,

THE ROVING "EYE" FROM UNDER SEA



The periscope of a submarine is nothing more than a long telescope with mirrors so arranged that it "sees" things at right angles. Here we see the observation room on a submarine (1) which is traveling with only the tip of the periscope above the waves. The observer turns the tube in the desired direction with those levers. In the upper corner (2) is shown the kind of picture that reaches his eye. Those graduated black lines across the field are to help him in judging the size and distance away of the ship under observation. Below (3) we have a shortened diagram illustrating the periscope principle. The upper mirror, set at an angle of 45 degrees, reflects the image downward through the lenses to the lower mirror, which is at the same angle, and from there it passes through the eye-piece to the observer.

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because of its greater speed, lighter draft, and heavier armament, practically immune against the submarine, namely, the torpedo-boat destroyer. To maintain a straight course, the submarine's torpedo must run about 15 feet below the surface, otherwise it will be diverted by the waves. As a destroyer has a draft of only nine or ten feet, a torpedo would pass under without touching it. On the other hand, its larger guns and heavier torpedoes enable the destroyer to smash the submarine in a stand-up fight, which that elusive craft risks as seldom as possible.

Fighting the U-Boat Menace

In spite of the practical immunity of the Allied fleet from submarine attack, the British admiralty early in 1917 disclosed to Admiral Sims that the U-boats were winning the war without battles. Battles, indeed, were not the business of the U-boat. In April 1917, the sinkings of Allied and neutral merchant shipping approached 900,000 tons. Destruction of merchant shipping, neutral as well as enemy, was the German objective, and no tenderness for human life was permitted to stand in the way of a campaign which was expected to starve the British Isles and strangle the Allied cause. Hence the *Lusitania* horror; hence, too, the sinking of hospital ships, which justified the expenditure of valuable torpedoes because this barbarity was expected to divert protection from merchant shipping by forcing the Allies to provide an escort for their hospital ships.

An extraordinary number and range of measures of relief and protection were adopted before the U-boat menace was brought under control. Ship construction was speeded up to an unheard-of degree. Merchant vessels were armed, camouflaged, and furnished with smoke boxes to throw overboard for a smoke screen when pursued. They displayed no lights at night. After May 1917, they sailed in convoys and close formation, under naval escort, over a zigzag course. Listening devices or hydrophones of various kinds, making use of the fact that water is an excellent medium for the transmission of sound, were perfected to such a degree that it was often possible to ascertain the approximate location of a submerged submarine by the sound of its machinery. Destroyers and submarine chasers patrolled infested regions. Airplanes and "blimps," hovering above, were often able to sight a submerged U-boat, invisible from the surface. In 1918 it became practicable to pen the U-boats up in their nests to some extent by great mine barrages like the one constructed in the North Sea chiefly by the United States navy. "Mystery" or "Q-ships"—war vessels disguised as tramp freighters and worked by naval officers and men—lured many U-boats to destruction. At first a submarine could escape all molestation from surface craft by diving, but the invention of the depth bomb cancelled that immunity.

Contrary to prophecy, the deadliest enemy of the submarine proved to be the submarine itself. The 500 Allied torpedo-boat destroyers sank a greater number of U-boats than did any other type of craft, but the 100 Allied submarines sank nearly as many.

The idea of a boat which should run under water had haunted the minds of inventors since early in the 17th century, and had proved fatal to several. The modern submarine is an American invention. David Bushnell's *Turtle*, invented in 1776 and used during the Revolution in an unsuccessful attempt to blow up a British man-o'-war in New York harbor, embodied all the fundamental principles of modern submarine construction. Robert Fulton offered the idea first to Napoleon and then to the British prime minister Pitt; but although he demonstrated his craft by blowing up an old ship for each, he obtained no recognition for his submarines either from European states or his own government. The Confederate submarine *Hundley*, which

STRANGE! THEY SEEM HAPPY!

Here are some members of an American submarine crew "on deck" while the craft is running on the surface. Although their work is exceedingly dangerous, they appear happy.

blew up the U. S. S. *Housatonic* in Charleston harbor in 1864—and perished in doing so—was the first to sink a hostile vessel.

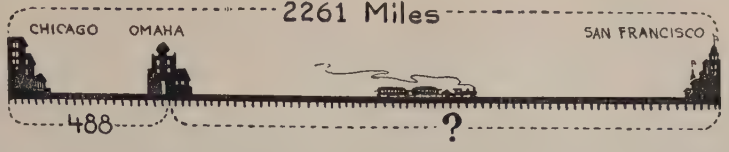
John P. Holland, an Irish-born American, devised the type of submarine which has been largely adopted as the model for the world's navies. His ninth model, launched in 1898, was the first practically successful submarine. Another American inventor, Simon Lake, contributed to the development of the undersea boat, as did also numerous foreign inventors, working for the navies of Germany, Great Britain, France, and other countries.

Have They Any Peaceful Use?

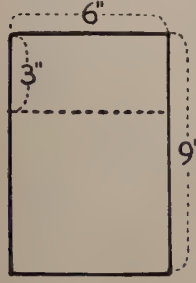
The merchant submarine *Deutschland*, which visited Baltimore in July 1916, and New London, Conn., in November of that same year, demonstrated the value of a submarine blockade-runner. Whether there is any legitimate peacetime use for submarines seems exceedingly doubtful.

PRACTICAL HELPS *in Learning* SUBTRACTION

SUBTRACTION. Suppose we wish to know the distance from Omaha to San Francisco. We find that Omaha is 488 miles from Chicago by railroad, while San Francisco is 2,261 miles from Chicago. The solution of this problem means that we must compare these two distances with a view to finding the *difference* between them; or, looking at it in another way, of finding how much greater 2,261 is than 488. To help us solve this rather difficult problem, let us first consider some simpler examples.



1. If a sheet of paper is 6 inches wide and 9 inches long, how may it be cut to make it square? Since we know from our study of addition that $9=6+3$, we cut off 3 inches from the longer side. When we place a 6-inch line beside a 9-inch line we find that 3 inches must be added to the 6-inch line to make it 9 inches long, or that 3 inches must be taken from the 9-inch line to make it equal to the 6-inch line. In other words, 3 is the *difference* between 6 and 9.



2. One basket of grapes weighs 9 pounds, another 14 pounds. How much more does the heavier one weigh? 5 pounds is the *difference* in weight.

3. It is 10 o'clock. How many more hours to 12 o'clock? 2 hours is the *difference* in time.

In the paper problem above, the difference can be measured directly. In the weight and time problems that follow it, the difference can be found by counting from 9 up to 14 or from 10 up to 12, as the case may be, e. g.—10, 11, 12, 13, 14 (5 numbers counted, then 14 is 5 greater than 9). Differences, however, need not be counted if the *addition* facts are known. For example, since $9+5=14$, when 9 is given it follows that to make 14, 5 more are needed.

Remainders

4. If from a rope 15 feet long a piece 8 feet long is cut, how much rope remains?

Solution: Here we may count the numbers from 8 to 15 and find that there are 7 of them. Hence the *remainder* is 7 feet. A better way is to remember that if 8 is one of the two numbers whose sum is 15, the other is 7. It is clear that a remainder left after taking away part of a number is found just as an excess or a difference in value is found between two numbers.

5. Henry had 17 marbles and lost 9. How many had he left? We may count from 9 up to 17 and conclude that Henry had 8 marbles left; or we may set out 17 counters, then remove or subtract 9 of them and count the number left. The latter is the traditional notion of subtraction. The first method of ascertaining remainders by counting up (the "additive" method) seems to be simpler than the "taking away" or "straight" method, and is consequently adopted for further treatment of this subject.

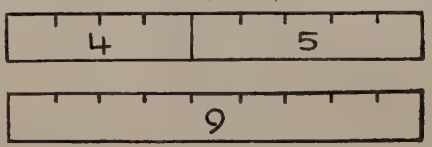
To compute *differences* or *remainders*, it is necessary to know 81 elementary subtraction facts or combinations, as follows:

2/1/1	3/1/2	4/1/3	5/1/4	6/1/5	7/1/6	8/1/7	9/1/8	10/1/9									
	3/2/1	4/2/2	5/2/3	6/2/4	7/2/5	8/2/6	9/2/7	10/2/8	11/2/9								
		4/3/1	5/3/2	6/3/3	7/3/4	8/3/5	9/3/6	10/3/7	11/3/8	12/3/9							
			5/4/1	6/4/2	7/4/3	8/4/4	9/4/5	10/4/6	11/4/7	12/4/8	13/4/9						
				6/5/1	7/5/2	8/5/3	9/5/4	10/5/5	11/5/6	12/5/7	13/5/8	14/5/9					
					7/6/1	8/6/2	9/6/3	10/6/4	11/6/5	12/6/6	13/6/7	14/6/8	15/6/9				
						8/7/1	9/7/2	10/7/3	11/7/4	12/7/5	13/7/6	14/7/7	15/7/8	16/7/9			
							9/8/1	10/8/2	11/8/3	12/8/4	13/8/5	14/8/6	15/8/7	16/8/8	17/8/9		
								10/9/1	11/9/2	12/9/3	13/9/4	14/9/5	15/9/6	16/9/7	17/9/8	18/9/9	

The thirty-six combinations on the right of the heavy lines are usually learned in the Second Grade.

The forty-five combinations on the left of the heavy lines are usually learned in the First Grade.

These must become thoroughly familiar, but they should require little practice if the addition facts are well committed. Since $4+5=9$, then it follows as a



consequence that $9-5=4$; also $9-4=5$. If 4 and 5 put together make 9, then when either is wanting the other is needed to make 9.

Here is a drill chart for subtraction. Draw it upon a blackboard or on a large sheet of paper, put in the center as minuend some number between 10 and 20, and give quickly the difference or remainder as the other numbers are pointed to. Change the number in the center frequently.

3	7	4
6		8
2	9	5

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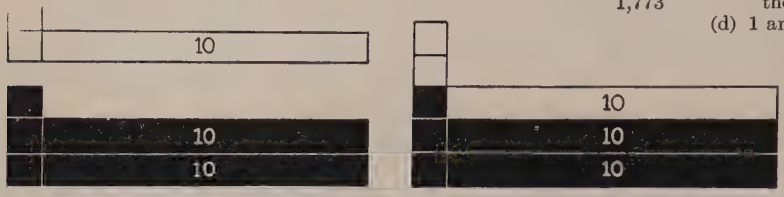
Computing

Cut strips of paper 10 inches long and 1 inch wide for the tens and squares 1 inch long for the ones.

1. How much more than 23 is 35?



Solution: (a) 3 and what make 5? (Set down the 2.)
35 (b) 2 tens and what make 3 tens? (Set down
23 the 1 ten.)
12 (c) Then 23 and what make 35?

2. What is the difference between 43 and 75?

Solution: (a) 3 and what = 5? (Set down the 2.)
75 (b) 4 tens and what = 7 tens? (Set down the 3
43 tens.)
32 (c) Then 43 and what make 75?

3. Find the remainder when 43 is taken from 68.

68 (a) 3 and what number make 6 tens?
43 (b) 4 tens and how many make 6 tens?
25 (c) Then 43 and what make 68?

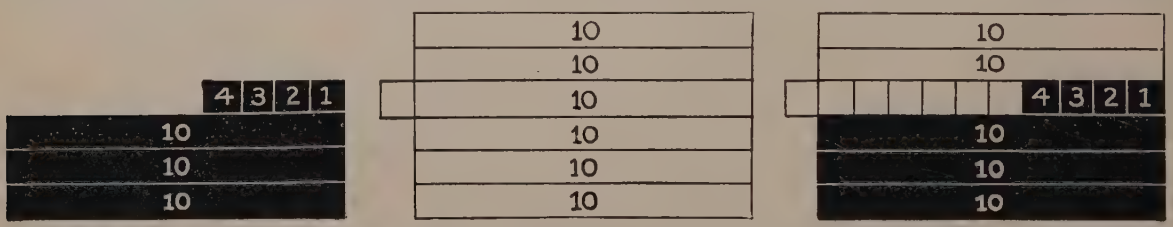
4. 61 is how many more than 34? To understand the solution better, look at this addition:

34
27
61

Omit the lower number, but keep the sum.

34
+ what
= 61?

11 must have been the sum of the first column. Why? Then what was the missing figure under the 4? 4 and what make 11? When the 1 was set down, 1 was also carried to the tens column. What was the missing figure under the 3? 4 tens and what = 6 tens? Then what was the missing number?



Solution: (a) Since 4 is greater than 1, we count up from 4 to 10 and then 1 more. 4 and what = 11?
61 (*See* the figure above.) Set down the 1.
34 Carry 1 ten to 3 tens.
27 (b) 4 tens and how many = 6 tens?
(c) Then 34 and what = 61?

Answer: The difference is 27.

We may now solve the problem we asked at the beginning, about the distance between Omaha and San Francisco. We know that Omaha is 488 miles from Chicago, and that San Francisco is 2,261 miles from Chicago. To find the distance between Omaha and San Francisco we subtract the former number from the latter, working the problem out in this way.

Solution: (a) 8 and what number = 11? (Set down 3. Carry 1 to the 8 tens.)
2,261 (b) 9 and what = 16? (Set down 7. Carry 1 to
488 the 4.)
1,773 (c) 5 and what = 12? (Set down 7. Carry 1 to the vacant place.)
(d) 1 and what = 2? (Set down 1.)

Answer: The distance is 1,773 miles from Omaha to San Francisco, because the latter place is 1,773 miles farther from Chicago.

Terms Used in Subtraction

In a subtraction problem, the number *diminished* or the greater of the two numbers compared is called the *minuend;* the number subtracted or the lesser number of the two compared is called the *subtrahend;* the number left after subtraction is called the *remainder;* the number by which the greater exceeds the less is called the *difference.*

864 *minuend*
218 *subtrahend*
646 *remainder* or *difference*

Checks or Tests

1. Add the subtrahend and remainder or difference. If the work is correct, the sum equals the minuend.

864 *minuend*
218 *subtrahend*
646 *difference*
864 *minuend*

2. Subtract the difference from the minuend. The result should be the subtrahend.

864 *minuend*
646 *difference*
218 *subtrahend*

Accuracy and speed in subtraction are secured by these things: (1) by mastering the "fundamental facts"; (2) by using as few words as possible in computing; (3) by forming the habit of testing the correctness of each answer.

Problems for Practice

Find the difference:

1. 876−324=?
2. 968−453=?
3. 694−427=?
4. 786−329=?
5. 5,344−2,788=?
6. 4,213−3,679=?
7. 50−31=?
8. 400−224=?
9. 7,000−2,132=?
10. 10,000−4,654=?
11. 962−47=?
12. 875−39=?
13. 7,832−456=?
14. 3,010−2,703=?
15. 40,060−3,245=?
16. 400,200−346,132=?
17. 1,687−499=?
18. 529−372=?
19. 93−57=?
20. 392−28=?
21. 880−257=?
22. 84−35=?
23. 5,643−2,326=?
24. 1,400−826=?
25. 3,008−573=?
26. 5,280−4,913=?
27. 6,973−3,010=?
28. 1,771−785=?

Subtraction

"O please dear Mr. Arithmetic
I'm Minus, Take Away,
Do let your figures every one
Come out with me and play."

Soon out they ran-the figures gay-
And Equal, also, came.
And then with Minus managing
They planned a lively game

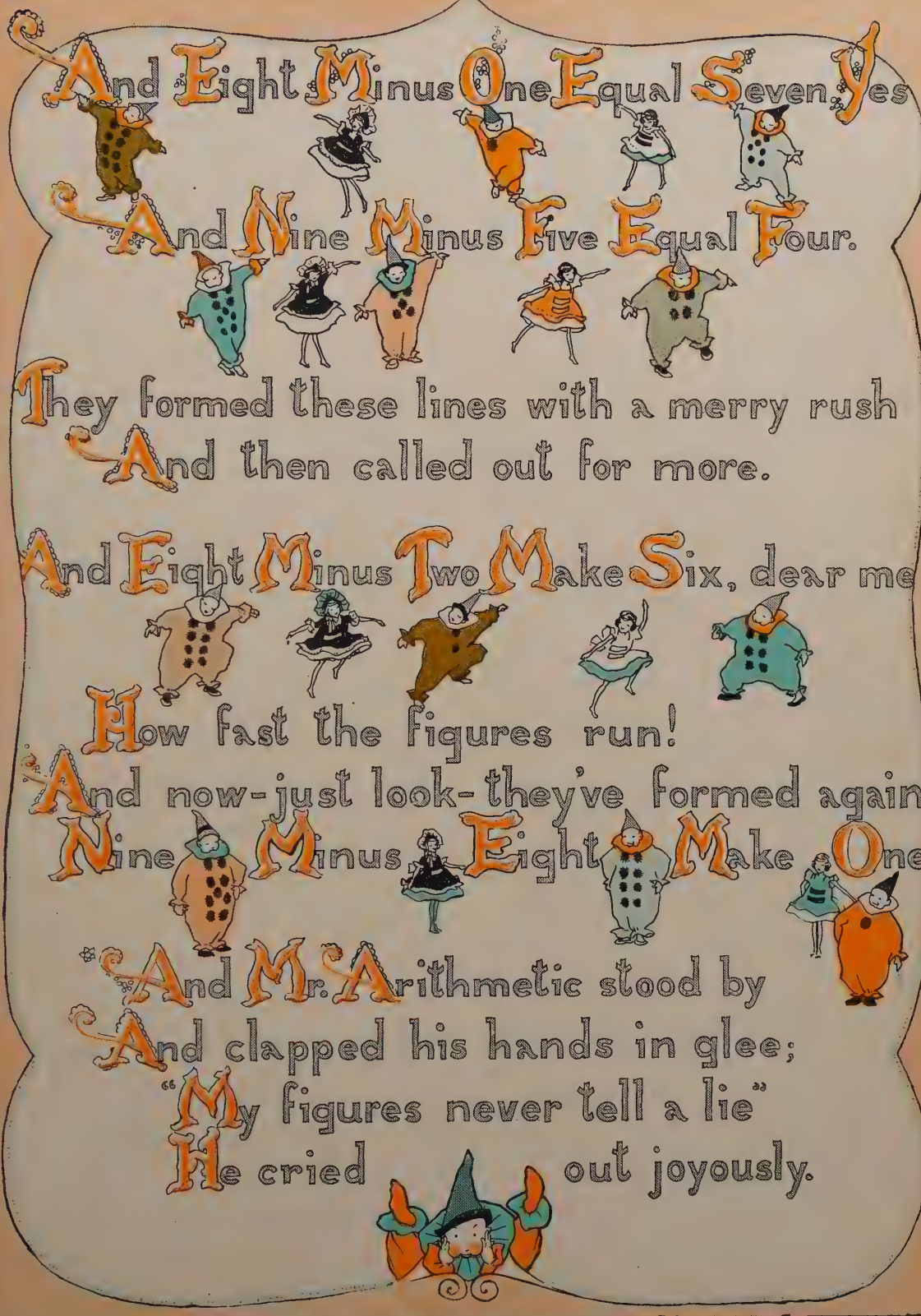
"Just watch me! Watch me!" Minus cried
Before the game began.
"I'll take my place, then you take yours
As quickly as you can."

She called for figures Nine and One
And then skipped in between;
And like a flash, to end the line,
Equal and Eight were seen.

"Nine Minus One Equal Eight" they cried
With all their might and main;
Then broke the line with a whoop and yell
And began all over again.

And Minus then looked around and said,
"I next choose Five and Three;
Five Minus Three Make Two, of course
As plain as plain can be."

Next Six Minus Four stood in a row,
Then Equal came-and Two,
For Six Minus Four Make Two each time
You know they always do.


And Eight Minus One Equal Seven, yes
And Nine Minus Five Equal Four.
They formed these lines with a merry rush
And then called out for more.
And Eight Minus Two Make Six, dear me
How fast the figures run!
And now-just look-they've formed again
Nine Minus Eight Make One
And Mr. Arithmetic stood by
And clapped his hands in glee;
"My figures never tell a lie"
He cried out joyously.

SUDAN'. The region in central Africa stretching south of the Sahara Desert to the maritime countries of the west coast and the basin of the Congo, and from Cape Verde on the Atlantic coast to the Red Sea and the Abyssinian and Galla highlands on the east, is called "the Sudan," the full name being *Beled-es-Sudan*, an Arab term meaning "country of the blacks." It has an area of more than 2,000,000 square miles and a population (chiefly negro and a few Arabs) estimated at between 10 and 20 millions. The eastern part, called the Anglo-Egyptian Sudan, has been governed by Great Britain and Egypt since 1899. The western and central portions are divided into a number of native states, virtually all of which are under French or British control. The land ranges from steppe-like plains and open forests to elevated plateaus and lofty mountains. Lake Chad, near the center, has an area varying from 10,000 to 20,000 miles, according to the season; it has no outlet but its waters are fresh. The Niger River, in the west, is the greatest avenue of travel, being navigable by small steamers for more than 1,200 miles, to Timbuktu—the center of the caravan trade in west central Africa. The climate, animals, and products are tropical. (*See* Africa; Egypt.)

SUEZ (*su-ĕz'*) **CANAL.** Many men in many ages from the days of Harun-al-Raschid had had the idea of cutting a canal across the Isthmus of Suez, and centuries before that the pharaohs of Egypt had connected the Nile and the Red Sea. But as for a Suez Canal they continued to write about it and talk about it while vessels still continued to make their wearisome way around Africa in order to reach India. Nobody really undertook the cutting of the great ditch a hundred miles long that would unite the waters of the Mediterranean and the Red Sea and shorten the dreaded ocean journey. Finally there came a French engineer, Ferdinand de Lesseps, who got the necessary rights from the viceroy of Egypt, organized a company in 1858, and built the Suez Canal in ten years, completing it in 1869. He had really made a dream come true by thus shortening the journey from London to Bombay by 5,000 miles—from 11,220 miles to 6,332.

Although one of the great feats of modern engineering, the Suez Canal did not present the difficulties encountered later on at Panama. Being at sea-level it needed no locks, and except for one place where the workers had to cut a passage 90 feet deep and 200 feet wide through sandstone rock the digging was mostly in soft materials. Often it amounted only to deepening a channel through lakes and lagoons already existent. The first work was done by fellahin with basket and hoe. Humanitarian feeling put a stop to this forced labor with its terrible toll of life and led to the introduction of machinery.

Complete at last at a cost of about $83,000,000, the canal, the longest in the world, was opened in November 1869, with pomp and splendor. The khedive of Egypt commissioned the Italian composer, Verdi, to write the opera 'Aida' for the occasion, built the Cairo Opera House for the gala performance, and even constructed a five-mile road and embankment to the Pyramids so that his royal visitors might drive out in comfort. Elaborate ceremonies also took place at Port Said—named after Said Pasha who had given de Lesseps the concession—and 68 vessels of different nationalities proceeded through the canal, headed by the *Aigle*, with the wife of Napoleon III, the French empress Eugenie, on board.

As you approach the canal from the Mediterranean side the first thing that you will notice is the great lighthouse more than 20 miles out. Later you will catch a glimpse of the two piers, a mile and a mile and a half long, that guard the entrance against the strong currents of the Mediterranean. At the landward end of these is a colossal statue of de Lesseps. You have now reached Port Said, once so wicked a city that you would not have dared set foot on shore after dark, but now no worse than you would expect a city to be that houses thousands of coal passers busy by torchlight as well as by day in coaling the great ships that come through.

For most of the way the Suez Canal is simply a ditch that looks hardly broad enough to accommodate the 11,000-ton liner on which you are traveling. If two ships meet, one of them must tie up to the shore or enter a side basin. Mail steamers have the right of way. It is a hot, uninteresting journey of $16\frac{1}{2}$ hours through the canal and the Red Sea from Port Said to Suez, another made town whose shops and people are the travelers' first foretaste of the Far East.

The canal is managed by a joint-stock company whose rights expire in 1968. Most of the funds for building the canal were supplied by France and Egypt. Englishmen subscribed nothing to the original enterprise and the British government opposed de Lesseps' project for fear of its effect on their ocean-carrying trade. In 1875 when the khedive of Egypt was about to sell his personal shares to the French, the British government stepped in and bought them and now controls a majority of the stock. About 5,000 vessels pass through the canal in normal years, carrying about 300,000 passengers.

SUFFRAGE. "Who shall be allowed to vote?" is one of the questions which must be answered in drawing up the constitution of any self-governing organization, whether it is a school society, a city or state government, or a league of nations. This right or privilege of voting we call *suffrage*.

Until recent years suffrage was restricted in most countries to males above the age of 21. Other requirements that are practically universal are citizenship and a certain term of residence in the state and district in which one votes. In the United States the suffrage is granted and controlled by the states, and not by the Federal government. As a result there are many different requirements for the suffrage. The idea that the right to vote is one of the "natural rights" of mankind would find its logical conclusion in universal

adult suffrage, but in most of the United States the suffrage is restricted by the exclusion of criminals, idiots, illiterates, and sometimes other classes. A property qualification is now seldom required. Woman suffrage, the right of women to vote on the same or almost the same terms as men, spread rapidly in the 20th century, both in the Old World and the New, and in 1920 was embodied in the United States Constitution by the 19th Amendment (*see* Women's Rights).

Previous to the Civil War most of the states withheld the right to vote from negroes. By the 15th amendment to the Constitution, the states are forbidden to abridge suffrage "on account of race, color, or previous condition of servitude." Other conditions have been imposed, however, by some of the states by which negroes in those states are for the most part now disfranchised. In North Carolina and Louisiana all persons whose fathers and grandfathers enjoyed the suffrage in 1867 may enjoy it without regard to other qualifications. Some of the Southern states have used educational tests in order to disfranchise the ignorant element among the negroes. (*See* Elections.)

The HISTORY *of a* LUMP *of* SUGAR

The Sugar Cane of India and How the Arabs Brought It to Europe—How a Taste for Sweets Helped to Discover America, and How it Played a Part in the Napoleonic Wars—A Visit to a Sugar Factory

SUGAR. It is sometimes said that Americans eat almost their own weight in sugar every year. Like other English-speaking peoples, they have an exceedingly "sweet tooth" and eat about three times as much sugar in proportion to population as the average European nation. The sugar consumption of a country is often referred to as an indication of its prosperity. The amount of sugar used in the United States is twice as great now, in proportion to population, as it was 50 years ago; and sugar is by far the largest of all imports both in tonnage and value.

Sugar is a comparatively modern product. The ancient Greeks and Romans had no sugar, and used honey instead for sweetening. Sugar was produced first in India, as early as the 1st century of our era, either from the bamboo or from sugar cane or from both; but for many centuries it was used only as a medicine or as a rare delicacy at feasts.

The Arabians, who gave Europe so many wonderful things, brought the sugar cane plant from India to the west, and also gave us its name—for the word "sugar" is Arabic. First they introduced the cultivation of the plant into the valley of the Tigris and the Euphrates, then into Egypt, and finally into Spain. It was not until the time of the Crusades (12th and 13th centuries) that sugar became generally known in Europe. The earliest record we find of sugar in England was at the beginning of the 14th century, when it was used only as a medicine. Two pounds of it cost as much as a pig, or as much as a carpenter could earn in 10 days.

How Sugar Helped Discover America

By the close of the 14th century Europe had developed a flourishing trade in sugar and other Oriental products by the overland route. Venice remained the great central market of this trade until the beginning of the 15th century, when Vasco da Gama made his memorable voyage around the south of Africa and discovered a water route to India. Columbus too was seeking a water route for the trade in sugar and spices when he discovered the New World.

Soon successful efforts were made to grow sugar nearer home. From Madeira and the Canary Islands the sugar cane was introduced into Haiti, Cuba, and other islands of the western Atlantic, and then into Mexico and Brazil. The sugar and spice trade was immensely valuable, and one of the great motives which impelled Spain, France, England, and other European nations to reach out after tropical and subtropical colonies was to obtain a sugar supply. Sugar cane was first grown in the English colonies in North America in 1751, but the industry was of no importance until about 75 years later.

Introduction of the Sugar Beet

Up to the time of the Napoleonic wars, at the beginning of the 19th century, practically the whole of the world's sugar supply came from the sugar cane, which grows only in tropical and subtropical lands. To-day half of the world's sugar is produced in the temperate regions of Europe and the United States from the sugar beet. The first serious attempt to utilize this source of supply was made by Napoleon when the Allies were blockading the ports of continental Europe, and cut off the imports of sugar. Napoleon made large grants of land and money to encourage the sugar beet industry, and many factories were established in France and Germany. In the latter half of the 19th century the new industry advanced by leaps and bounds in Europe, but it did not become important in the United States until the final decade of the century.

The world's great "sugar bowls" today are Cuba, India, Java, the Hawaiian and Philippine Islands, and Porto Rico. These are the great producers of cane sugar. Beet sugar is grown chiefly in Germany, Russia, Austria-Hungary, France, and the United States. Louisiana produces nearly all of the cane sugar grown in the United States, but Alabama, Mississippi, Florida, and Texas also grow some, chiefly for making syrup. The leading sugar beet states are Colorado, California, Utah, and Michigan; for sugar beets grow best in rich soil, with plenty of

moisture in the spring, a dry summer, and cool dry weather in the fall. Excellent results are obtained by irrigation, and semi-arid sections of the West have become large producers.

A field of sugar cane looks a little like a field of corn, but the cane is usually much taller than corn, sometimes reaching a height of 20 feet. The stalks grow thickly crowded together, each with a large branching cluster of leaves at the top like a feather duster. The plant belongs to the grass family, the same family as bamboo and corn. The stalk is divided into many joints, like the bamboo, sometimes as many as 60 or 80. At harvest time the workers go into the field with broad sharp knives and cut the stalks and strip the leaves away. The yield per acre will sometimes be as high as 40 or 45 tons. The juice is about 10 to 20 per cent sugar.

PLANTING AND HARVESTING THE SUGAR CANE CROP IN THE HAWAIIAN ISLANDS

On the left the mule is bringing up a load of cane to be planted in the furrows of the irrigated field. In every joint of the cane is a bud or eye which will sprout if properly planted and watered. The seed cane is cut from the tops of untasseled cane. Practically all Hawaiian sugar land has to be irrigated; irrigation is used also in Porto Rico and South and Central America. On the right is the full grown sugar cane jungle.

At the mill the juice is squeezed from the stalks by sets of heavy rollers, each set squeezing a little harder than the one just preceding it. The stalks are sometimes torn in a "shredder" before they go to the rollers, and are moistened with steam and water to aid in the extraction of the sugar. When the last set of rollers has squeezed the crushed stalks, or "bagasse" quite dry, the fibrous mass is carried away to the power-house to be used as fuel.

Since the raw juice contains impurities which hinder crystallization, milk of lime is added to precipitate these foreign substances. Sulphur dioxide is forced into the mass to neutralize the excess of lime, and to bleach and further purify it.

The juice is then evaporated in vacuum pans into a thick syrup, and finally to sugar crystals. In a few places the boiling is still done in the old-fashioned way, in open pans, but boiling in vacuum pans is much quicker and cheaper. Part of the syrup does not crystallize and remains clinging to the crystals. The whole sticky brown mass is then put into great whirling drums called "centrifugals," and most of the syrup, now properly called "molasses," is forced out through the perforations in the drum, leaving the sugar inside. The molasses is boiled and crystallized once or twice more, producing an inferior grade of sugar. From the final process, the molasses is used for the manufacture of rum, alcohol, as food for stock, and sometimes for fertilizer.

The "raw sugar" is now ready to be shipped in bags to the sugar refineries. It still contains many impurities, which give it a color varying from dark brown to nearly white, and it must go through the "refining" process before it is ready for the market. In the United States the great refineries are in Brooklyn, Philadelphia, New Orleans, and San Francisco. Here the sticky dark raw sugar is mixed with water and again whirled in centrifugal machines. This again produces molasses and sugar crystals, which are considerably whiter than those obtained before. These crystals are again dissolved in water and passed

FROM SUGAR BEET TO SUGAR BOWL

These pictures show the process whereby we get sugar from sugar beets. In the upper left-hand corner is a sugar beet, sliced into "cossettes" and ready to yield its juices. Next to it you see the top of a battery of "diffusion tanks," arranged in a circle. Each new lot of cossettes is packed into one of the tanks, and water is turned on. The water visits each of the tanks in turn, absorbs the sugar contained in the cossettes, and passes to the purifying tanks, where it is treated, first with caustic lime and then with carbonic acid gas. The lime seizes upon impurities, and the gas precipitates the lime. Then the liquid visits the filter press, where the precipitate is removed, and goes to the evaporator, which reduces the liquid to a somewhat thick sirupy consistency. After being subjected to sulphur fumes, which remove more impurities, the thickened liquid passes through cloth filters and is ready for the graining process. This is conducted in huge copper cylinders, called "vacuum pans." These cylinders are heated by steam coils, and an air pump maintains a partial vacuum within them, in order to permit boiling at low temperature. The heat causes the sugar to gather into crystals within the liquid. The crystals are then removed from the liquid by the centrifugal drier, the last moisture is driven out by the hot-air drier, and the sugar is graded for size, weighed, packed, and shipped.

contained in the Easy Reference Fact-Index at the end of this work

through cotton filters, from which the liquid comes out a clear light yellow. The soluble impurities which give the liquid this color are now removed by filtering through bone-black, and then the refined syrup is ready for the final processes—boiling in vacuum pans, crystallization, and whirling again in the centrifugal machines. Sometimes a little bluing is added to increase the whiteness. The sugar remaining in the drums is now pure white granulated sugar, and after being dried and packed it is ready for the market.

Up to a generation ago the liquor from these vacuum pans was poured directly into large conical molds about 18 inches high, where the sugar crystallized into the once familiar "sugar-loaf." These were then dried and wrapped in blue paper for the market. From these loaves the sugar was broken off as needed, or they were sawed up into cubes called "cut-loaf" sugar.

Today cube sugar is usually made by pressing moistened granulated sugar into molds. Sometimes it is made by running the sugar from the vacuum pans into molds about 14 inches long, 8 inches wide, and half an inch thick; these slabs are then drained in the centrifugal machines, dried in ovens, and passed through machines which cut them into the lumps we use in our coffee. Powdered or confectioner's sugar is obtained by grinding the best grades of granulated sugar and sifting the powder through silk bolting cloth. Brown sugar is the poorer grade of sugar made from molasses.

How Beet Sugar is Made

The process of making sugar from beets is the same in principle as in making cane sugar. But the entire manufacture is conducted in one factory, while the cane sugar goes through part of its manufacture in one place, and then is taken to the refineries for the rest of the process.

First the farmers bring their beets in wagons to the factory, where the beets are stored in sheds shaped like great troughs. A flow of water carries the beets through the sheds to the washer. From this they drop into elevator buckets and are carried to the slicing machines at the top of the building. There sharp knives on revolving disks cut them into little V-shaped slices known as "cossettes." These are soaked in warm water and the sugar contained in them dissolved in what is known as the "diffusion battery," a series of 10 or 12 tanks, each capable of holding from two to four tons. The warm water is forced through these cylinders, one after another, and when it is finally led off from the last tank it contains the beet juices, as well as impurities that must be removed. This is done by adding milk of lime and carbon dioxide gas, and filtering in huge filter presses. After repeating the process, the purified liquor which flows from the second filter is reheated and treated with sulphur dioxide to bleach it. After a final filtering it passes to the vacuum pans for boiling, and finally to centrifugal machines.

The molasses thrown off in the centrifugals in beet sugar making is not a palatable article of food, like the molasses from cane sugar; so it is diluted and again boiled and whirled in another set of centrifugals. The product is a brownish sugar and what is called "second" molasses. The brown sugar goes back into the diffusion tanks, to emerge finally as granulated sugar. The second molasses, in addition to some further sugar, yields "press cakes" for cattle feed and potash needed as fertilizer.

The beet sugar industry in the United States is still in the experimental stage, and experts are uncertain whether it can continue to be conducted at a reasonable profit. While the sugar cane requires little cultivation and is grown in lands where labor is cheap, the sugar-beet makes heavy demands on labor, requiring deep plowing, thinning or weeding out, and constant cultivation. In the United States, where the cost of farm labor is the highest in the world, this is an important factor. Against this must be set these advantages of sugar-beet cultivation—that the pulp and other by-products are valuable as cattle feed and fertilizer, and that when the sugar-beet is planted in rotation with other crops it improves the fertility of the soil.

Sugar is almost the only food that is entirely digestible, being without any waste whatever. Because it is digested with extreme rapidity, it may be used instead of a stimulant to delay fatigue, and is without the injurious reaction that follows the use of a stimulant. It is peculiar among foods also in being of uniform composition—pure carbohydrate and therefore pure fuel.

It occurs in nearly all fruits. The sugar-beet is merely one of several sugar-storing roots, with its sugar content greatly increased by cultivation, and the sugar maple is not the only plant which has sugar in its sap, though it has an exceptionally high proportion of sugar (*see* Maple). Cane sugar and beet sugar are the same chemically. There is no difference between them when highly refined.

There are many sweet substances called sugars, of which sucrose (cane or beet sugar) is the most familiar. They are all composed of carbon, hydrogen, and oxygen. Chemists divide the common sugars into two classes: the monosaccharides, and the disaccharides—single and double sugars, as it were, the disaccharide molecule being capable of splitting up into two monosaccharide molecules.

Our table sugar (sucrose) is a disaccharide ($C_{12}H_{22}O_{11}$); so are maltose, a sugar formed by the action of malt on starch, and lactose or milk sugar, which occurs in milk and some other animal fluids and is the foundation used in preparing homeopathic pills.

The most common monosaccharides are glucose or grape sugar, which is found in crystalline lumps in raisins (dried grapes), and fructose or fruit sugar, which is used as a substitute for cane or beet sugar in the diet of diabetic patients. A mixture of glucose and fructose, called "invert sugar," is found in honey and many sweet fruits. Glucose and fructose are also called dextrose and levulose because the one rotates polarized light (*see* Light) to the right and the other to the left. Commercially, the name glucose (*see* Glucose) is given to corn syrup, which owes its sweetness chiefly to the glucose or grape sugar it contains.

When sucrose is heated with a little water until it melts and begins to turn yellow, it forms on cooling a hard glassy mass called "barley sugar." If heated still more it partially decomposes, leaving a soluble brown material called "caramel" which is used to color food and beverages. When boiled with water containing a small quantity of acid, cane or beet sugar is "hydrolyzed" or "inverted," giving a mixture of dextrose and levulose. This mixture does not readily crystallize, and so when the housewife makes soft candy or icing for cakes, she adds a small quantity of vinegar, lemon juice, or cream of tartar to the sugar, turning some of it to "invert sugar."

Saccharin is a white powder manufactured from coal-tar. It is 300 times sweeter than cane sugar, but has little food value. It is much used commercially for sweetening candies, pastries, and preserves.

SULPHUR. Gathered from the throats of volcanoes and forming compounds that smell like the nether regions, sulphur seems like the black sheep of the family group headed by the powerful and highly respectable element oxygen. It is sometimes, indeed, a nuisance. Silver teaspoons tarnish when used with eggs because the sulphur in the egg forms a blackish silver sulphide over the surface of the spoon. That same sulphur forms an alliance with hydrogen to assault your nose with the horrible odor of rotten eggs (hydrogen sulphide or sulphuretted hydrogen). The pungent and to some people scarcely less objectionable odor of cabbage, onions, turnips, and mustard is due to sulphur compounds. Burning matches, because of the burning sulphur they contain, give off a suffocating fume of sulphur dioxide which rasps the throats of people and blackens the surfaces of metals. A very little sulphur makes iron brittle, and the sulphur from a sulphur-containing coal will attack and ruin grates and boilers.

Sulphur gets into mischief because it is an exceedingly active substance. But its activities are so varied, useful, and indeed indispensable to us that we can afford to overlook its peccadilloes. Modern industry could scarcely "carry on" without sulphur and its compounds, particularly one invaluable acid (*see* Sulphuric Acid). Sulphur enters into most of the proteins, those remarkable complex substances which are so important in animal tissues and in many vegetable structures. Human hair contains the exceptionally high proportion of 5 per cent sulphur.

Because it burns so easily, the ancient popular name of sulphur is "brimstone" or "brennestone" —that is, "burnstone." For the same reason the alchemists regarded it as the principle of combustibility and we use it in matches and gunpowder.

It occurs free in volcanic regions all over the earth and still more widely diffused in compounds. The world's commercial supply used to come almost entirely from Sicily, but now it is also mined in various parts of the United States. The main source of American sulphur is the vast Louisiana deposit, 125 feet thick on the average, and buried beneath 90 feet of soft rock and 375 feet of clay, sand, and gravel. (*See* illustration under article Louisiana.) It seemed as if it might as well have been in the mountains of the moon; all attempts to mine it failed for nearly 40 years after the discovery of the beds. Since 1903 it has been successfully mined by an ingenious process invented by Herman Frasch, a petroleum expert. Several steel pipes, of sizes ranging from 13 inches to 1 inch in diameter, are driven, one within the other, deep into the sulphur bed. Water, heated far above the boiling point, is pumped down the outer pipes. Melted sulphur, heavier than water, collects in a pool around the lower end of the pipes. Air, compressed to a pressure of about 250 pounds to the square inch, is forced down the central 1-inch pipe, and the melted sulphur, more than 99 per cent pure, rises to the surface through the next encircling pipe.

DERRICKS IN A LOUISIANA SULPHUR FIELD

In the foreground is a storage pit; in the distance the power house which furnishes the power by which the sulphur is brought to the surface.

"Dr. Jekyll and Mr. Hyde" was a simple proposition compared to the multiplex personality of sulphur, which assumes at least six well-known disguises or "allotropic modifications," and some others which are in doubt as being possibly not pure sulphur. It crystallizes in two forms, the rhombic (ordinary form) and monoclinic; it has several amorphous (shapeless or non-crystalline) states, some soluble and some insoluble.

Sulphur is a non-metallic element, with an atomic weight of 32. The symbol is S. It melts at 235° F. (113° C.); you see why the water used in mining it has to be heated *above* the boiling point. When melted it becomes a clear yellow liquid, but as the temperature is further raised it darkens and thickens, until about 256° F. (180° C.) it is too solid to be poured; heated still further, it liquefies again, reaching the boiling point at 832° F. (444° C.)

It is sold in several forms: as a light yellow odorless and tasteless powder called simply "sulphur"; in solid rolls or cones, known as "roll sulphur" or "roll brimstone"; and in very finely powdered forms, one, known as "flowers of sulphur" or "sublimed sulphur," obtained by cooling sulphur vapors in a large room so that they condense and "snow down" in fine crystals, and another, known as "milk of sulphur," "lac sulphuris," or "precipitated sulphur," obtained by precipitation from solution. "Roll brimstone" is sometimes burned in old buildings to kill vermin; pets, jewelry, silverware—everything which could be injured by sulphur dioxide fumes—must first be removed, and then the doors, windows, and all crevices tightly sealed while the sulphur burns. Precipitated sulphur and sublimed sulphur are used in medicine.

Among the more important sulphur compounds, apart from sulphuric acid, are sulphur dioxide (SO_2), bleach and insecticide; the poisonous and explosive liquid carbon disulphide (CS_2), solvent, disinfectant, and insecticide; ferrous sulphate (green vitriol or copperas), mordant for dyes, insecticide, water purifier, used in the manufacture of inks and pigments; copper sulphate (blue vitriol), mordant and germicide; sodium thiosulphate, commercially known as hyposulphite of soda, used in photography, tanning, dyeing and bleaching; and the alums, complex double sulphates, used in dyeing, paper-making, and tanning, and generally as astringents. Of the sulphur compounds occurring in nature, some are valuable ores, as cinnabar (mercuric sulphide) and galena (lead sulphide); iron pyrites or "fool's gold" (iron disulphide) is sometimes used as a source of sulphur.

Sulphuric acid. Like the heroine of some old folk-tale, who finds her bread baked, her floor swept, and her flax spun by unseen hands, we—that is, civilized people—are served by innumerable helpers whom we may never see. One of the busiest of these unseen servitors is sulphuric acid.

From the time we get up in the morning to put on clothes dyed and bleached by the aid of sulphuric acid, until we are lighted to our beds at night by electricity conducted over wires of copper which have been refined by the aid of sulphuric acid, we are constantly depending on this powerful and active servant. The bristles in our hairbrushes were treated with sulphuric acid. It probably entered into the manufacture of the paper on which and the ink with which this book is printed. The gasoline which drives your automobile was refined with sulphuric acid. The very bread on your table may be made from wheat grown with fertilizer produced from phosphate rock by treatment with sulphuric acid.

We find industrial processes which do not directly involve sulphuric acid, and we may think that in these we have escaped the general dependence; but even here, if we follow the trail far enough, we are likely to find that the material or the tools or machinery required sulphuric acid in their production. As Ellwood Hendrick says in 'Everyman's Chemistry', "We can neither go to war and have smokeless powder nor can we live in peace without it. Wherever you go in civilization you cannot get out of its path. You may never see it, you may not know its qualities and its very remarkable chemical personality, and you had better not touch it, but almost invariably it has been around before you." It has even been said that the wealth and prosperity of a people can be estimated by their consumption of sulphuric acid.

A Violent Chemical

Sulphuric acid is never satisfied, chemically speaking, with things as they are; it must always tear other compounds apart and make new ones by combining with them. In doing so it chars paper, cloth, and wood, eats into flesh, acts as a violent poison, and is generally dangerous and destructive. It is a good servant, though a bad master; the same qualities which are so dangerous uncontrolled make it invaluable when we want to break up a refractory chemical compound and rebuild it into something else. Sulphuric acid (H_2SO_4) is, for instance, the main reagent in the Leblanc soda process for splitting sodium chloride or common salt into sodium and chlorine so that soda or sodium carbonate may be made from the one and hydrochloric acid from the other; and, whatever may happen to the historic Leblanc process, sulphuric acid and soda remain the founders and regents of the realm of industrial chemistry (*see* Sodium).

The old name of sulphuric acid, "oil of vitriol," is now strictly applied only to the 93.5 per cent acid, a colorless, oily-looking liquid, very greedy of moisture and therefore used as a drying agent. The ordinary acid, containing from 30 to 38 per cent water, is known as "chamber acid" from the lead chambers in which it is made.

The manufacture of sulphuric acid is one of the great chemical industries, although it does not figure in commerce to any great extent because it is so difficult to ship the acid safely that large consumers generally make their own. There are two important processes of manufacture. In the old lead chamber process—to give a mere skeleton of some rather complicated reactions—sulphur in the form of "brimstone" or pyrites or other compound is burned, giving sulphur dioxide. These fumes then pass through a series of lead chambers in which they react with steam and certain oxides of nitrogen to form the diluted chamber acid which may be evaporated to obtain a more concentrated acid. In the newer contact or catalytic process, the presence of a catalyzer (*see* Platinum) induces sulphur dioxide to unite directly with the oxygen of the air to form sulphur trioxide, and this can be dissolved in water to produce sulphuric acid of any strength.

Sumach (*shu'măk*). A familiar sight on hill and roadside in southern Canada and northern United States is the picturesque staghorn sumach, whose brilliant coloring in autumn is unexcelled even by the maple. It is a rugged-looking shrub or small tree with a lightly leaning trunk and crooked, many-forked twigs and branches, which somewhat resemble a stag's horns. In summer the downy green foliage

makes a fitting background for the dark red pyramid-shaped clusters of fruit, which grow on a long erect spike. The staghorn sumach sends forth its twigs and branches clothed with long soft pink hairs, which turn bright green, then brown, and finally, in their second summer, become short and almost black. The fruit clusters, too, are covered with down, crimson in color. The wood, which is soft and brittle with a satiny surface, is used for walking-sticks, boxes, inlay work, and various ornaments.

Another member of the sumach family, quite as attractive as the staghorn, is the dwarf, or mountain sumach, which is common in the eastern states and is found as far west as the Rockies. Its leaves and bark are used in tanning leather, and also furnish a yellow dye. The poison sumach, found in swampy land from New England to Minnesota and from Georgia to Texas, may be readily distinguished from other species by its drooping clusters of greenish-white fruit.

Besides these three sumach trees, there are more than a hundred species found in the temperate regions of both hemispheres. The famous lacquer of Japan is produced by a sumach tree which is cultivated expressly for its milky juice. Other species are extensively cultivated in southern Europe for use in tanning and dyeing.

Scientific name of staghorn sumach, *Rhus hirta* or *Rhus typhina*. A shrub or small tree from 10 to 30 feet high, found from Canada south to Georgia. Bark smooth, dark brown. Wood orange color, streaked with green, coarse-grained, light. Leaflets long or rounded with fine-toothed margins; alternate on petioles from 16 to 24 inches long; bright green above, whitish underneath, turning crimson or gold in autumn. Scientific name of dwarf sumach, *Rhus copallina;* of poison sumach, *Rhus vernix*.

SUMATRA. Picture yourself among the coconut trees of the warm, rainy, palm-fringed island of Sumatra, on the Equator! Look up in the branches! See that brown monster chinning himself with one hairy arm 'way up in the greenness? That is the powerful pig-tail ape, and he's gathering coco nuts up there for the dark-skinned natives below. They have trained him to do so.

This stout fellow is only one of the many kinds of apes and monkeys that prowl around with the elephant, the two-horned rhinoceros, the wild hog, the Malay bear, and the tiger, through Sumatra's dense mountain forests of teak, camphor, oak, myrtle, fig, the dreaded upas trees, and many others. In such forests—which are so dense that an ape can cross this huge island swinging from tree to tree—lurk crocodiles and cobras and pythons yards long. Hundreds of species of birds enliven the day with jungle medleys, and gigantic bats explore the night in dizzying swoops and curves.

Lakes and Volcanoes

In these lofty mountain ranges crossing the island are a dozen steaming volcanoes, and many enormous mirror-like lakes in the craters of extinct volcanoes. The western slopes descend rapidly to the sea, and the eastern slopes look out over silvery plains crossed by partly navigable rivers of rare beauty. Perhaps the island's beauty may account for its name, for "Sumatra" in Arabic means "the happy."

The natives of this Dutch dependency are of different tribes of the Malay family, varying in language and civilization. Most of them farm, tilling their fields with their huge buffaloes. Some are still practically savages, and frequently war on one another.

Although ancient inscriptions of the Hindus, who dominated Sumatra in its early history, call the island "the first Java," its natives are not docile like those of the more populous isle across the narrow Sunda strait to the southeast. They have always bitterly resisted the white man, and even today their conquest has not been entirely accomplished. Hence their country is far behind Java in development. The Achinese in the north have been especially troublesome. Wars against them have cost the Dutch more than 12,000 lives, and the interior is yet unsubdued.

How the Dutch Won the Island

A Hindu kingdom existed in Sumatra as early as the 7th century A.D. Mohammedanism began to make itself felt in the 13th century. Marco Polo visited the island in 1292, and the Portuguese arrived 16 years after the discovery of America. At the end of the 16th century, the Dutch drove out the Portuguese and since then have gradually extended their sovereignty.

Sumatra is the third largest island of the Malay Archipelago. It is 1,100 miles long, and has an extreme breadth of 250 miles. Its area of about 167,000 square miles equals the combined area of the New England states, New York, and Pennsylvania. If the island were placed upon the North American continent it would extend from St. Louis to Boston. Its population, however, is less than 4,000,000.

Padang and Palembang are the chief cities. The latter has the finest Mohammedan mosque in the East Indies. The land is exceedingly fertile and is also rich in minerals. Its most important product is its celebrated tobacco, large shipments of which go to the United States. Other important products are coffee, pepper, rice, sago, gums, rubber, coal, tin, petroleum, copper, iron, and gold. (For map, *see* East Indies.)

SUMNER, CHARLES (1811–1874). For nearly a score of years Charles Sumner, the anti-slavery agitator, was the most conspicuous figure in the Senate of the United States. Both physically and mentally he towered among his fellow-senators, in the period preceding and during the Civil War.

Sumner was born and bred in Massachusetts, of typical New England stock. After completing a course in the Harvard Law School, in 1834, he practiced law for three years, and then went abroad. During his next three years, in Europe, he formed acquaintances with leading public men which were of value to his country when he entered public life.

In 1845 Sumner began to interest himself in politics, and the same year he delivered the Fourth of July oration in Boston, taking for his subject, "The True Grandeur of Nations." It was in this address that he took the extreme ground that "there can be no peace that is not honorable; there can be no war that is not dishonorable."

This oration decided Sumner's future career. He had amazed himself, as well as his friends, by his powers as an orator, and he determined to go on the lecture platform. He at once became one of the most conspicuous foes of slavery, and as a result he was elected to the United States Senate in 1851 as a Free-soil candidate. During his first session in Congress he declared that "freedom was national; slavery sectional." When the Kansas-Nebraska Bill was introduced into the Senate Sumner opposed it with all his might, as one

> Who, momently by Error's host assailed,
> Stands strong as Truth in greaves of granite mailed.

In the course of these debates Sumner made some bitter attacks on the South, and on Andrew Butler, senator from South Carolina. As a result, he was brutally beaten over the head with a heavy cane by Congressman Preston Brooks, a relative of Butler's, while seated defenseless at his desk in the solitude of the senate chamber, after that body had adjourned. Sumner suffered from the effects of that attack all his life, and it was nearly four years before he was physically able to reënter public life.

Sumner returned to the Senate in time to take part in the last thrilling episodes which preceded the Civil War. During this period he opposed any compromise with the supporters of slavery. Emerson declared that for many years Sumner was the "conscience of the Senate," and Lincoln shrewdly characterized him when he said, "Sumner is my idea of a bishop." Unfortunately, Sumner seemed sometimes quite as much impressed with his own grandeur as with the grandeur of the nations, and his success as a public speaker made him seem conceited and overbearing.

During the Civil War he urged the immediate emancipation of the negro, and he was one of the foremost advocates of giving the ballot to the recently freed slaves. His greatest opportunity for service was as chairman of the committee on foreign relations. His knowledge gained during his three years' residence abroad was of inestimable value, but he sometimes seemed to forget that the chief direction of foreign affairs was not in his hands but in those of President Lincoln and of Seward, his secretary of state. With the latter Sumner was never able to coöperate effectively.

With the close of the war Sumner's period of greatest usefulness was over. Although he played a prominent part in the period of Reconstruction, it was not a part which was particularly helpful to the country. He was preëminently an agitator, and the time called for constructive work, not for agitation. This is probably the reason that today we do not rank Sumner as did the men of his own time, when they coupled him with Lincoln as "the two most influential men in public life."

OUR GIANT SUN *and Its* GIANT TASKS

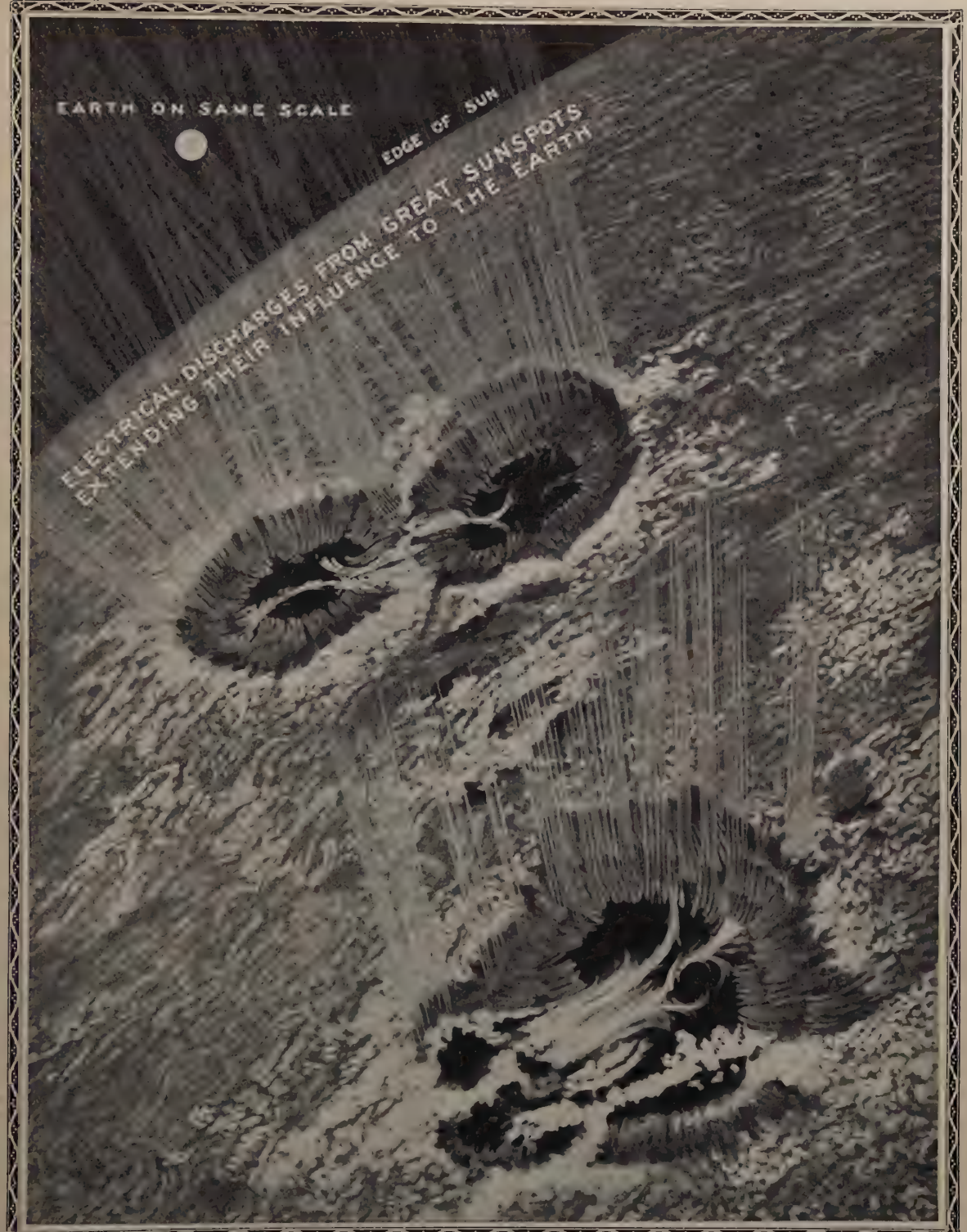
Besides Giving Us All Our Food and Heat and Light, It Makes and Distributes Our Weather, Keeps the Waterfalls Falling and the Winds Blowing, and Holds Big and Little Worlds in Their Appointed Paths

SUN AND SOLAR SYSTEM. A famous modern astronomer calls us all children of the Sun. Centuries ago the Incas of Peru also called themselves children of the Sun and performed strange ceremonies in worship of the king of the heavenly bodies. They were really wiser than they knew. Of course they were mistaken in thinking the Sun was a god, but they were right in believing that there would be no Earth—at least as we know it—and no people on the Earth if it were not for the Sun.

If the light of the Sun were suddenly shut off, we should soon perish from cold and starvation. In fact, if the Sun's heat were reduced by only 10 per cent, the whole of the temperate zone, the zone now inhabited by the majority of the human race, would be converted into frozen wastes. Perhaps we might keep warm for a while with the stock of coal still in the mines, but in the meantime our food supply would give out and there would be no way of replenishing it, for in such intense cold nothing would grow.

The very coal that we burn is a gift of the Sun, for coal was formed from giant ferns and other primitive plants which long ago stored up the rays of sunlight for our use today. From coal we get most of our power, but we also get power from windmills and waterfalls. Yet if we stop to think, we find that neither the windmill nor the waterfall would give us any power if it were not for the Sun. It is because the Sun heats some sections of the atmosphere to a higher degree than others that we have winds, and it is because the Sun vaporizes the water of the oceans and raises it to the hill and mountain tops that we have rivers and waterfalls. Thus the mighty Niagara is simply a tribute paid to the all-pervasive power of the Sun. Attempts have also been made to construct "solar engines" with giant reflectors which shall operate by means of the direct heat of the Sun's rays—and some writers predict that these will ultimately be found a great practical source of working energy. A solar motor in actual use in southern

FLAMING STORMS ON THE SUN'S FACE



Across nearly 93,000,000 miles of space—so far that the little pealike object in the left corner of the page, which represents the Earth, would have to be more than 200 feet away from the section of the Sun's disk if the distances were on the same scale as the objects pictured—electrical discharges beat down on our tiny planet. Well for us that the pulsing energy of the great life-giving dynamo in the sky never ceases; well, too, that we are at a safe distance from the flame-licked whirlpools into which our Earth might drop like a pellet of waste fluff shaken into the live coals of a grate fire! The study of these "sunspots", as they are called, has been for years one of the most interesting branches of astronomy.

contained in the Easy Reference Fact-Index at the end of this work

California consists of a 33-foot reflector with 1,788 small mirrors so arranged that they concentrate sunlight upon a boiler. About an hour of bright sunlight produces steam enough to develop about 12 horsepower. The whole apparatus is arranged to move by clockwork, like a telescope, so that the reflector always exactly faces the Sun.

But the Sun's influence is not exerted in light and heat alone, but also in the enormous force of gravitation by which it holds the entire solar system together. *Sol* is a Latin word for "sun," and the phrase "solar system" is simply an expression to indicate the group of heavenly objects which are actually held in captivity by the Sun. These objects include the eight large planets (of which the Earth is one), a large number of asteroids (which are really little brothers of the planets), and a much larger number of very small bodies which appear nearly every night as meteors or "shooting stars." All of these bodies move in almost circular paths around the Sun, simply because they can't get away. It is chiefly the power of gravity exerted by the Sun which keeps the Earth, for example, from flying off on a straight course into space. (*See* Asteroids; Meteors; Planets.)

THE MIDNIGHT SUN

This picture, taken on the desolate shores of Smith Sound, at the northern end of Baffin Bay, shows, by means of eight exposures made on the same plate, eight stages in the passage of the midnight sun across the sky.

Our Great Distance from Our Great Benefactor

The force of the Sun's attraction as exerted upon Neptune, the farthest of the planets, in its path around the Sun is equal to the pull of a column of steel 500 miles thick and 2,791 millions of miles long —for that is the average distance of Neptune from the Sun. In comparison we on the Earth are near neighbors of the Sun, for we are only 93 millions of miles away! But it isn't likely that we shall ever do much visiting, because even if we could travel in an airplane at the rate of 150 miles an hour it would take us at least 70 years to get to our journey's end. And if we should figure the rate of fare at three cents a mile the journey to the sun would cost us each about $2,790,000.

There is even a worse difficulty. Long before we got within hailing distance, the intense heat of the Sun would melt our airplane to bits and our expedition would end in grim disaster.

For the Sun is inconceivably hot. Its temperature is believed to be at least 10,000° Fahrenheit, which is several thousand degrees higher than any temperature ever obtained in any electrical furnace. Every known substance on the Earth, even the hardest stone or metal, would instantly turn to gas under such intense heat. This is one of the reasons why we believe that the sun is not a solid like the earth but is largely made up of gases.

But Where Does the Heat Come From?

What causes such intense heat? Even after offering all their explanations the scientists must admit that they are far from having completely solved the problem. We know the Sun is not burning in the usual sense of the word because in that case it would not be very long before it was reduced to dust and ashes, just as in the case of a fire on the Earth. If the Sun were actually burning, its fire would begin to go out within less than 1,500 years, even if it were made up of the best grade of anthracite coal. So the "combustion theory" will not do.

The most widely known theory is based on the fact that when gases contract they create heat. It is generally supposed that the Sun, being mostly composed of gases, is slowly contracting, and in this way continues to give off the enormous quantities of heat and light which fill the entire solar system. In recent years another belief has been growing, that besides this source of heat the Sun may also possess materials similar to radium, and if that is the case there is no danger of the Sun's "going out" for hundreds of millions of years to come.

Yet the Sun is so enormous that if contraction were the only source of its energy we could still expect it to radiate warmth and light for at least ten million years. By means of complicated measurements and computations astronomers have been able to determine very accurately the size and weight of the Sun. Its diameter is 864,000 miles, or about 108 times that of the Earth, and if we could put the Sun in a pair of scales we should have to use 329,000 globes like the Earth to bring the scales to a balance. In other words, the mass or weight of the Sun is 329,000 times that of the Earth. A small pea placed beside a large pumpkin gives some idea of the size of the Earth in comparison with the Sun.

Days of Wild Weather on the Sun

When we look at the Sun through a telescope we see it as a broad round white disk, marked here and there with little black splotches that look like holes

or caverns in the surface. These are the Sun spots which, even after years of study, are still a great mystery. They indicate, however, that the Sun is subject to terrific storms and eruptions, caused perhaps by cooler gases from high levels rushing in toward the center for a distance of thousands of miles. The form of these spots is constantly changing, yet they last long enough so that we can determine that the Sun rotates on its axis in a period of about 25 days. Oddly enough, the central part of the Sun, in other words its Equator, seems to rotate faster than the parts near the Poles.

The invention of the spectroscope (*see* Spectrum and Spectroscope) revolutionized the study of the Sun because it made it possible for astronomers to discover at least a great number of the materials composing the Sun. It is now quite certain that practically all the elements which have been found in the Earth's crust are to be found in the Sun also. This is one of the reasons for believing that at some time in the past the Earth split off from the Sun in the manner suggested by the planetesimal hypothesis (*see* Earth; Planets).

The white surface of the central body of the Sun is called the *photosphere* (light sphere). This is surrounded by a layer of incandescent gases which we call the *chromosphere* (color sphere). From the chromosphere, or even the photosphere itself, vast eruptions shoot up to heights ranging from 20,000 to 300,000 miles. These are *prominences*, the smallest of which would swallow up the Earth and all its inhabitants in a single mouthful. Beyond the prominences is a halo of light, called the *corona*, which can be seen only at the time of an eclipse of the Sun. (*See* Eclipse.)

SUN FLAMES BURSTING FORTH

Like a giant fiery bubble, this flame as it grew reached out farther and farther into space, to a height at last of probably 250,000 miles—more than 30 times the diameter of our Earth.

SUNDAY SCHOOLS. "Ah, sir! Could you take a view of this part of the town on a Sunday, you would be shocked indeed! The street is filled with wretches who spend their time in noise and riot, cursing in a manner so horrid as to convey an idea of hell." Thus a woman of the pin-factory district of Gloucester, England, spoke to Robert Raikes, editor of a Gloucester newspaper, nearly 150 years ago. Three years later Raikes wrote a friend as follows: "A woman who lives in a lane where I fixed a school told me that the place was a heaven on Sunday compared to what it used to be."

The school that worked this miracle was the first Sunday school, and the Gloucester editor was the father of the modern Sunday school movement. If Raikes could step into a 20th century Sunday school he would be amazed at the vigor of the grown-up child of his kindly spirit. His first Sunday school of 1780 had four teachers, whom he paid one shilling each for instructing the children in reading and the catechism, from 10 to 12 o'clock in the morning, and from 1 till 5 in the afternoon, taking them also to the regular church service. His pupils were children of the street, his equipment a Bible and a spelling book. Most of the children could neither read nor write, for this was 50 years before the beginning of government-aided education in England.

In the up-to-date city Sunday school of today he would find the children of the street and the children of luxury gathered about the same sandbox in the infant division. In the secondary or intermediate division he would find boys and girls of the age of those with whom he struggled busy drawing maps and pictures, or acting out a Bible story. He would find classes of adults furnished with such notebooks and other equipment as might be found in a college classroom. In some schools he would even find the pupils graded, as in a regular day school, with a six-year study course. The "shilling-a-day" teachers are replaced by volunteer workers from special training classes. Orchestras, special Sunday-school song books, lesson helps, picture cards, illustrated papers, and a score of other aids add interest.

If, finally, the good Robert Raikes could be told that one out of every six persons in the United States and Canada is a regular attendant of some Sunday school, that probably no city or village in all the land is without its Sunday school, he would say again as he said, with tears rolling down his cheeks, when he saw the changed neighborhood in which his first efforts had been so successful: "See what God hath wrought!"

From the first, Raikes' Sunday-school idea spread rapidly to other English cities. In America the religious instruction by pastors and deacons for

children of the congregation had early been a part of the Sunday service. But a more general Sunday school, on lines laid down by Raikes, was not organized in the United States until after the Revolution. The first was established in Virginia in 1786 by Francis Asbury, John Wesley's famous assistant and the first bishop of the Methodist Episcopal church ordained in America. Soon after this, Katy Ferguson, a poor negro woman of New York City, who had never heard of Raikes, organized a Sunday school for street children.

The rapid spread of the Sunday school in the United States was largely due to the American Sunday School Union, which was organized early in the 19th century. This organization sent out missionaries into the West in the first half of the century, and schools were formed from the Alleghenies to the Rockies and from the Great Lakes to the Gulf. The movement later became international. International conventions are now held every two years, and an international committee, appointed every six years, maps out the course of study which is followed in a large proportion of the world's Sunday schools, especially those of evangelical faith. Other church denominations, including the Catholic, have organizations and programs of their own.

SUNDEW. There is something almost human—or perhaps it would be more exact to say inhuman—about the way the treacherous little plant called the sundew ensnares its insect prey. The upper surface of each leaf is covered with about 200 hairlike projections or "tentacles"; these are provided with glands which give out a sticky fluid attractive to insects. Each leaf seems to be covered with hundreds of glistening dewdrops; hence the name. If an insect touches the tentacles it sticks fast. Then all the neighboring tentacles begin to bend toward the center of the leaf, rolling the insect along and making the leaf look like a little closed fist. As soon as the prey is caught the fluid secreted by the tentacles becomes acid, containing digestive properties which make soluble all of the nitrogenous parts of the insect.

After the insect is digested—usually about two days—the tentacles all recurve and the leaf trap is set for another visitor. In Portugal there is a plant related to the sundew which catches so many flies that the peasants hang branches of it in their cottages to rid themselves of these pests.

The sundew (genus *Drosera*) is one of the so-called "carnivorous" plants. Several species are found in North America. They are inconspicuous little plants, with round or oval leaves in a rosette, and they grow chiefly in swampy places. (*See also* Pitcher Plants; Venus's Fly-Trap.)

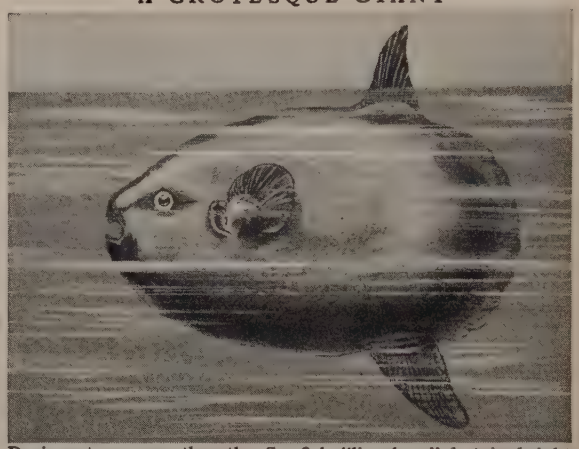
SUNFISH. Where is the rest of him? This is the first question suggested by a glance at the ocean sunfish. What a huge monster he would be, you think, if his tail were not "cut off just behind the ears!"

The true sunfish is this immense creature who wins his title by basking on the surface of the ocean in the hot light of noon. Specimens eight feet long and weighing 1,800 pounds have been caught.

The shape of this fish is like a watermelon seed, and he appears to be nothing but head. Above and below the part that would correspond to the neck are two big triangular fins. Just at the place where he should begin to widen out into a regular fish shape, he stops altogether. It is not surprising that scientists, gazing upon him in wonder, call him a *moloid pelagic plectognath*, or *Mola mola*, for short!

The ocean sunfish is a stupid fish, and will allow men in boats to approach quite close to him before he turns over and dives. For this reason he is easily harpooned, whereupon he puts up a tremendous fight, lashing the water with his two big fins and dragging the craft of his captors at considerable speed over the waves. The sunfish is found in almost all parts of the Atlantic and Pacific oceans. His flesh is not good for food, but he is sometimes caught for the oil which he produces.

A GROTESQUE GIANT



During stormy weather the Sunfish "lies low," but in bright sunny weather he loves to play about near the surface, swimming so high that his back fin projects as shown in the picture, or lying flat on his side. "Stupid," he is called; and he looks it, with that gaping mouth and round, surprised, staring eye.

Very different from this ocean monster are the little freshwater sunfish which are among the most characteristic, best known, and most highly esteemed of the game and food fish of the United States. The handsome and bold common sunfish (*Lepomis gibbosus*) is perhaps the best known of the family. The graceful little spotted sunfish, the long-eared sunfish, and the blue sunfish are other well-known members of the family (scientifically known as *Centrarchidae*), which also includes the black bass, calico bass, and crappie. Many of them build pebble nests in shallow water, where they will get the full force of the sun's rays, and the male keeps watch over the eggs until they hatch.

SUNFLOWER. When Champlain visited the Indians on the eastern shore of Lake Huron some three centuries ago, he found them cultivating the large common sunflower, the best-known of the many species of this familiar plant. They had probably brought it from its native prairies beyond the Mississippi. Its stalks furnished the red men with a textile

fiber, its leaves with fodder, its flowers produced a yellow dye, and its seeds furnished food and oil for their hair. Early European settlers in Canada were quick to appreciate the usefulness of this plant and sent seed home to Europe. It is now grown as a commercial crop in southern Europe, in India, and in Egypt; and Canadian farmers have successfully experimented with it as a silage crop. The oil produced from its seeds is nearly as good a drying oil as linseed oil.

The common sunflower is a giant among composite flowers, having large coarse heart-shaped leaves, and brown-centered golden blossoms which often measure nearly a foot across. Contrary to popular belief the flower does not turn to follow the sun, but gets its name from the resemblance of the golden-rayed heads to the sun.

Scientific name, *Helianthus annuus*. Flowerhead flat, 4 to 12 inches across, with brown round disk florets crowded in concentric circles on the flat round disk; ray florets yellow, numerous, long, radiating in series from the disk. Stem rough, hairy, 6 to 10 feet tall. Leaves large, broad, coarse, petioled, and usually growing alternately on the stem.

SUPERIOR, LAKE. The largest body of fresh water in the world, Lake Superior is also the deepest, the most northern, and the coldest of the North American Great Lakes. Its area is 31,200 square miles, and you may steam for 30 hours across its surface without sighting land, for it is 400 miles from end to end. In places the water is 1,008 feet deep, the bed of the lake lying 406 feet below ocean level and the surface 602 feet above. Even summer rarely brings its temperature much above 40° F., and until far into May its ports are icebound.

From the rocky and wooded shores more than 200 streams pour their waters into Lake Superior. Of the islands, the largest, Isle Royale, more than 40 miles long, falls within the United States boundaries. At the western end of the lake lies the great double port Duluth-Superior, at the edge of the iron regions of Minnesota and the farming country of the west. From here giant freighters carry their cargoes of ore and grain down through the locks of the Sault Ste. Marie at the eastern end, on their way to other ports of the Great Lakes, the return freight being largely coal. About midway on the southern shore the spur-shaped peninsula of the "copper country" juts 60 miles into the lake. Here one-seventh of the world's supply of copper is mined every year, and vessels have been known to set out from the ports of Keweenaw Bay bearing a cargo of copper ore worth a million and a quarter dollars. Lake Superior whitefish are highly esteemed throughout the Middle West, and other fish from these cold clear waters are among the best to be found in all the lakes. (*See* Great Lakes.)

SURVEYING. How do you know where the boundaries of your farm or city lot are? Because they have been mapped or laid out by skilled surveyors. It is by surveying that the boundaries of cities, states, and countries are laid out, as well as of private lands; and surveying is also used in locating streets, roads, railroads, and all other positions or courses on the earth's surface. Surveyors must know geometry and trigonometry and be able to use delicate instruments with great accuracy. In big cities land is often worth hundreds of dollars a square foot, and an error of a fraction of an inch would be costly.

Surveying, which—at least in a rudimentary form—is nearly as old as civilization, is a branch of civil engineering. It is the science of ascertaining the shape and size of any portion of the earth's surface—that is, the relative location of points and lines—and representing them on maps or diagrams. It includes also the reverse operation of locating or staking out on the ground points and lines drawn in plans or maps—as for the construction of buildings, railways, canals, and the like.

There are two principal kinds of surveying—plane and geodetic. Plane surveying—including land, topographic, and hydrographic surveying—deals with comparatively small areas. It treats the earth's surface as a plane, disregarding its curvature. Geodetic surveying or "geodesy" deals with larger areas and is more accurate, taking into account the curvatures of the earth's surface.

WOULD YOU LIKE THIS JOB?

This is the way a surveyor often has to work along portions of the Florida, Porto Rican, and Philippine coasts. There the land is covered with a dense impenetrable mat of vegetation and the shore is fringed with semi-liquid mud flats, so that the hard coral bottom of the waters off shore frequently affords the only available support for the plane table.

The simplest method of land surveying is to divide the ground to be surveyed into several triangles and to calculate the area of these triangles. A base line of convenient length is marked off and measured with the greatest accuracy. Another point is chosen for the apex of the triangle and the angles it makes with each end of the base line are measured. From these angles and the length of the base the area of the triangle is calculated. By continuing this process until the whole piece of land is covered with a network of triangles, the location of all important points throughout the entire area is computed. A number of spots

are marked with monuments, to serve as starting points for any local surveys that may be desired.

In making his measurements and determining his angles, the surveyor uses special instruments of great accuracy. The principal instrument is the "transit" (an improved form of the "theodolite"), which consists of a telescope mounted on a tripod with a compass and a leveling glass attached. If a straight line running northward is to be laid out, the instrument is swung around until the compass shows that it is pointing directly to the north, then the surveyor looks through the telescope, while his assistant carries a long rod forward, planting it in the ground at the direction of the surveyor in the exact line of sight, determined by a hair which is stretched perpendicularly across the inside of the telescope. The transit is then moved up and planted exactly over the spot marked by the rod, the assistant moves forward again, and the whole process is repeated. If the line is to bend at a certain angle, a scale on the transit tells when the telescope has been moved to that angle and the sighting goes on as before.

When distances are measured along the line of sight, wire chains or metal tapes are used. For farm or public land surveys in the United States the Gunter chain is used, which is 66 feet long, divided into 100 links each 7.92 inches. These are units of acre measurement. But for more accurate engineering work, steel tapes marked in inches, feet, and ten-foot lengths are used. For very accurate work, tapes are made of "invar," an alloy of nickel and steel which does not expand or contract in response to any changes of temperature ordinarily encountered.

The "level" is an instrument somewhat like the transit, but used chiefly to determine grades, that is, the amount of rise and fall of the ground surface. In the field, it serves chiefly for railway and topographic surveys, the latter being the surveys that give us the outline and altitudes of hills and mountains, as distinguished from plane surveying, which is used in fixing land boundaries, etc.

The most accurate of all surveying is geodetic surveying, which takes into account the curved surface of the earth in determining the distance between points. Geodetic surveys are carried on by governments to fix exactly the coast-lines, the varying heights of the ground surface over vast areas, the exact positions of important points, the areas of states, of large bodies of water such as the Great Lakes, and the course of international boundaries. For this purpose geodetic survey stations are established in various parts of the United States, Canada, and Mexico, whose exact positions are determined by astronomical observations, corrected by an exceedingly complicated process of triangulation. The central station for North America is at Meades Ranch, Kan.

Hydrographic surveying deals with the area, shape, and depths of bodies of water, and is made with the assistance of soundings. By this means, channels, banks, and sunken reefs are charted, and ocean depths marked on maps. (*See also* Lands, Public.)

FEATHERED HERALDS *of* SPRINGTIME

SWALLOWS, SWIFTS, AND MARTINS. Are you troubled by mosquitoes and flies? Put a martin house in your dooryard and you will soon be relieved of these pests. For the martin and his relatives, the 200 species of swallows and swifts, are insect-eating birds and feed especially on the small flying varieties. They capture them in the air, and so keep their mouths widely agape when on the wing.

The swallow family is known and loved throughout the world. To many the unfailing sign of spring is the arrival of flocks of these picturesque steel-blue birds. The pointed wings and forked tail are characteristic of the family, which in general has dark over-plumage, changing to lighter below. The species vary in size from five and one-half to eight inches, but the habits are similar for all.

They live mostly on the wing. In migrating, unlike other birds, they travel only during the day, for they can feed as they fly, roosting in marshes or trees at night. Most of the swallows nest in colonies and all lay from three to seven eggs. The choice of place and the manner of building, however, varies widely with the different species.

The purple martin is the aristocrat of the swallow family and prefers to carry the leaves, straw, and mud with which he builds into a box erected for his use. This home he defends against any other bird, even the crow or hawk. His entire body is covered with dark steel blue, the wings and tail being almost black-purple. The violet-green swallow, not five inches long, lives in the western United States. It is named for the colors on its back, the belly being white.

The barn swallow, with his under-feathers of chestnut red, is the master mason of the family, and constructs a wonderful little nest-house of straw, held together with mud-pellets, and attached under the eaves or against the beams of buildings and under the ledges of cliffs. As the song says:

> The swallow is a mason,
> And underneath the eaves
> He builds a nest and plasters it
> With mud and hay and leaves.

Bank and rough-winged swallows have a curious way of tunneling into a sand-bank, sometimes to a depth of three to five feet. Into this burrow they carry straws and sticks and build a bulky nest.

The tree swallow, the first to arrive at his Southern home in the spring, and the last to leave it in the fall, builds in hollow trees and does not live in colonies.

CHIMNEY SWIFT AND HER NEST

A gypsy corrupted by civilization, the Swift has forsaken the hollow tree in which it used to build its home for a disused chimney.

The swift, often wrongly called the "chimney swallow," belongs to quite a different family, but he and his numerous relatives dress in much the same style and enjoy as wide popularity as do the swallows. The swift, like the swallow, is a mason, but he furnishes his own mortar. His nests are constructed of twigs, held together by a firm glue-like substance which, in a liquid form, flows from the mouth of the bird during the mating season. In some cases, notably in that of the swifts of Japan and China, the nests are composed entirely of this glue, with perhaps a feather lining. These nests are considered a rare table delicacy, and "bird-nest soup" is a dish of which both Japanese and Chinese are very fond.

Swifts are from five to seven inches long and in general of a soot-black or brown color above and lighter below. Because of the shape of its claws the bird never perches on trees or other objects, but alights in a hollow tree or chimney where it clings to the sides by its sharp claws, supporting the body by pressing the tail against the wall. In such homes they glue their shelf-like nest so firmly that it supports not only the mother but also her five or six babies. Of course if the chimney is heated, disaster follows.

When the children are able to fly, the swifts gather in immense flocks and use the same chimney for sleeping quarters. John Burroughs tells of watching 10,000 swifts playing above a single tall chimney, into which the entire flock finally disappeared for the night. This they continued to do for a whole month before migrating to the south.

There is a touch of mystery about the swift's migration. No one has yet discovered where they spend the time from fall till spring. In November they gather on the northern coast of the Gulf of Mexico, an innumerable host. Then they disappear! The last week in March a joyful twittering far overhead announces their return to the Gulf Coast. Where they have been in the meantime is still the swifts' secret. (For illustrations in colors of barn swallow and chimney swift, *see* Birds.)

BARN SWALLOWS

This is one of the hungry chattering broods that populate the eaves of barns and other farm buildings. Before men provided the Barn Swallow with a nesting place, it used to build in caves, niches in rocks, or hollow trees.

Swallows belong to the family *Hirundinidae*. Scientific name of purple martin, *Progne subis;* barn swallow, *Chelidon erythrogaster;* tree swallow, *Iridoprocne bicolor;* bank swallow, *Riparia riparia*. The swift belongs to the family *Cypselidae*. Scientific name of chimney swift, *Chaetura pelagica*.

PURPLE MARTINS

This village of gourds houses a colony of the "biggest, handsomest, jolliest, and most domestic" of the swallow family—the Purple Martin.

Swan. The swan is the "royal" bird, so called because in England up to the time of Queen Elizabeth no subject might possess a swan without license from the Crown. The title still clings to the bird, probably because the dignity of its appearance makes it peculiarly apt. The swan frequently appears in myth and fable, and its beautiful plumage, the proud poise of its graceful neck, and its stately movements have made it a favorite subject in literature.

Swans belong to the same group as the geese and ducks, and are almost exclusively aquatic birds. There are eight swan species. They are all large birds, characterized by the length of neck, which in some species is longer than the body. The plumage is generally pure white, sometimes dark about the head. Young birds, called "cygnets," have brown feathers, which are shed for white the second year. The call note is loud and trumpet-like.

The distribution of the swan family is very wide. Wild swans breed in the arctic region, migrating to warmer climates in the winter. The nest of the swan is a large pile of reeds and water plants, and the eggs, about six in number, are of a greenish hue. The birds feed on seeds, roots, small water creatures, and fish spawn.

The common swan of Europe is also called the mute swan, for it is said never to use its voice in captivity. This species, the best known of the family, reaches a length of five feet and a weight of 30 pounds. The plumage is spotless white, the bill of orange-red surmounted by a black knob, and the legs are black. Domesticated swans of this species consort freely with wild swans, which migrate southward toward

STATELY SWANS LIKE GREAT WHITE LILIES

The Common or "Mute" Swan is the most graceful of any of the swan clan when swimming. Its whiteness as well as its grace is proverbial. A "black swan" to the ancients was a synonym for a freak of nature.

winter and are found on the shores of the Mediterranean and even in India.

South America is the home of the black-necked swan, a smaller bird with white plumage except for the head and neck of dark seal-brown. Australia has the black swan, with sooty black plumage, white primaries, and coral colored bill.

In North America the family is represented by two species—the trumpeter swan, the largest of North American wild fowl, and the whistling swan. Both are now exceedingly rare, though once considerable flocks were met with. These birds have a great variety of calls, ranging from the high-pitched note of the young birds to the bass-horn notes of the old males. The "swan-song" of the dying birds, so long regarded as a pleasing myth, has actually been heard from birds of these species as, after being wounded, they slowly sailed to earth on set wings.

Scientific name of common European swan, *Cygnus gibbus;* trumpeter swan, *Olor buccinator;* whistling swan, *Olor columbianus.*

SWEATSHOP SYSTEM. This term is applied to a system—now happily unlawful in most states—under which men, women, and even children are employed in the manufacture of ready-to-wear clothing or other commodities under such wretchedly insanitary conditions and at wages so low that the contractor or employer is said to "sweat" his employees. The name was given the system by an English social writer, Charles Kingsley, who was one of the first to agitate for the reform of this industrial abuse.

A congressional investigation in the United States in 1892 showed that 30 per cent of all clothing manufactured in the country was made under the sweating system. Sometimes the work was done in a crowded room hired by the contractor, without proper sanitary arrangements; sometimes the work was done at home, where the garments or cigars were often handled by consumptives and filth abounded among the wretched toilers. In many cases the workers toiled 15 hours a day, seven days to the week, at wages so low as barely to enable them to keep alive.

The chief industries in which "sweating" occurred were the making of garments, cigars, candy, and bread. It is a common error to assume that only cheap clothing is made in sweatshops. The fact is that cheaper clothing is apt to be made in large factories, where system and machinery reduce cost to the minimum, while the more expensive ready-to-wear garments, both for men and women, are often made in sweatshops.

Although most states have enacted laws which are intended to end the evils of the "sweating" system, and require sanitary conditions for the production of goods, an army of inspectors finds enforcement difficult, because the sweatshop workers, who depend on the contractors for their meager living, elude discovery by keeping on the watch and smuggling the garments into their homes. The formation of protective trade unions among the workers is difficult, in view of the cheap labor from foreign countries. The action of the National Consumer's League in allowing its labels to be placed only on goods made under decent conditions of work and of wages and in pledging its members to give the preference to such goods has produced some result, and only requires that consumers support it.

For any subject not found in its alphabetical place see information

SWEDEN'S FROSTY LAND and STURDY PEOPLE

Flying without Wings—Ski-Jumping is One of the Favorite Winter Sports in Sweden

Extent.—North to south, about 1,000 miles; east to west, about 250 miles. Area, 173,035 square miles. Population, about 6,000,000.

Physical Features.—Surface in general an undulating plateau falling in terraces from the west to the low Baltic plain on east and south. Chief mountain range the Keel (or Kiolen), which separates Sweden from Norway; highest peak, Kebnekaise (7,005 feet). Many lakes and rivers, occupying together more than 8 per cent of the area. Largest lakes: Wenner (2,149 square miles); Wetter, Mälar, Hjelmar. Rivers: Dal, Klar, Ljusne, Tornea, Kalix, Lule, Skellefte, Ume, Windel.

Products.—Oats, rye, barley, potatoes, sugar beets, wheat, hay, flax; cattle, sheep, goats, reindeer; dairy products; herring and other fish; iron, copper, zinc, manganese, lead, silver; iron and steel products; timber, furniture, matches, and other wood products; paper, porcelain, glass.

Principal Cities.—Stockholm (capital, about 410,000); Göteborg, 200,000; Malmö, 112,000; Norrköping, 58,000; Helsingborg, 46,000.

SWEDEN. Glistening birches waving like fairy wands against a clear blue lake, set in a lovely landscape of woodlands and rolling pastures; fair rosy-cheeked maidens with long tresses, and tall sturdy lads, all in their gay peasant costumes, singing and dancing in the violet light of the midnight sun; their lilting, haunting melodies—"Sing hoppsan sa, follerallala!"—ringing from group to group and echoing from all the hills. These memories are of Sweden's Midsummer's Eve, that gayest of festivals—Midsummer's Day, June 24th—which is a legal holiday in Sweden. All the houses are bedecked with green birch boughs, from Sweden's most beloved tree, and from every village green rises the gaily decorated "May-pole," symbolic of the renewed fertility of Mother Earth.

The short glad summer, coming on the heels of winter in a sudden burst of green, is the busiest time of Sweden's year, for sowing and harvesting must be done in the few brief months before the long dark winter again claims the earth. Sweden lies so far north, one-seventh of it north of the Arctic Circle, that the summers are very short and the winters from seven to nine months long, with very little spring and autumn between. Since the western mountains shut off the tempering winds from the Atlantic, the extremes of temperature are greater than in Norway. The ports on the Gulf of Bothnia are frozen several months in the year, and except in very mild winters navigation is impeded along the northern and central parts of the Baltic. In summer there are only two or three hours of darkness, and in winter only two or three hours of daylight; and so the people of Sweden can all sympathize with the child in Stevenson's verse:

> In winter I get up at night
> And dress by yellow candle light;
> In summer, quite the other way,
> I have to go to bed by day.

In the very northernmost regions the sun does not set at all for a whole month during the summer, and for a month during the winter it does not rise above the horizon.

In spite of this topsy-turvy arrangement, the Swedes are a happy optimistic people, full of the joy of life, and sturdy and healthy as well. The winter is not a season of gloom for them, for their outdoor sports make it a period of delight. Then the whole country is one vast expanse of hard crisp snow, over which one may glide with incredible speed on sleds or on the long slender skis. All the boys and girls, as well as the older folks, take their daily recreation in this way. The farmer drives his sleigh across the country straight as the crow flies, for all barriers lie buried

deep beneath the snow; and lakes and rivers are frozen deep, offering wonderful opportunities for sleighing and for skating, in which the Swedes are said to be the most expert of all peoples. Wonderfully healthful, too, is this bracing winter air, making Sweden the healthiest country in Europe, with the lowest death rate and the greatest average length of life.

DANCERS IN NATIVE COSTUMES

In Dalecarlia, the "region of dales," about 100 miles north of Stockholm, the peasants still wear the costumes their ancestors wore, speak their own dialect, and preserve their folk dances. The Dalecarlians are known for their gallant spirit, and were the staunchest supporters of Gustavus Vasa in the conflict which freed Sweden from Danish rule.

Sweden occupies the eastern and larger part of the great Scandinavian peninsula, with an area somewhat greater than that of California. It is separated from Norway on the west by the high plateau, studded with the lofty peaks of the Kiolen or Keel Mountains, from which the land slopes steeply to the east and more gradually to the south. (For map *see* Norway.) Its head, separated from Finland on the north by the Tornea River, rests beyond the Arctic Circle; its base, nearly 1,000 miles farther south, upon the waters of the Skagerrack, the Kattegat, and the Baltic Sea. On the east the land ends in low, sandy, and often marshy shores along the Gulf of Bothnia, becoming more rocky in the southern part bordering on the Baltic Sea. On the southwestern coast, along the Skagerrack, the Kattegat, and the Sound, low sandy shores alternate with steep cliffs, which, however, are rarely more than 30 feet in height. The entire coast is studded with islands, the largest of which are Öland and Gotland off the southeastern coast. With its enormous coast-line, more than 1,400 miles in length, and its many good harbors, it is no wonder that Sweden has large maritime interests and a merchant marine of nearly 3,000 vessels. Herring and other fish abound in the sheltered sounds between the islands and the coast and contribute an important part to the national wealth.

These are Dalecarlian peasant girls in holiday attire. The striped aprons are the most colorful part of this national costume, the stripes usually being bright reds, greens, and yellows, set off by black.

Sweden is divided into three parts or provinces—Norrland, Svealand, and Götaland—which together cover an area of more than 170,000 square miles, and have a population of nearly 6,000,000. Svealand, in the middle, the original Sweden proper, is the region of great lakes and birch woods, of prosperous farms and flourishing towns, the center of the political and intellectual life. Here is Stockholm, the capital and largest city, with its stately buildings, its splendid harbors, its numerous islands, and its myriad waterways, considered by many the most beautiful capital in Europe (*see* Stockholm). Lovely Lake Siljan, the "Eye of Dalecarlia," one of the beauty spots of Sweden, is in this province. The peasants of Dalecarlia ("the Valleys") still wear their picturesque costumes, and here we must go to see the midsummer festivities in their most charming and romantic setting. A little to the north of Stockholm is the famous university town of Upsala, the chief seat of learning of the country. In ancient times Upsala was the seat of the Swedish kings and of the pagan worship of the Norse gods, Odin, Thor, and Freya. It now contains the cathedral (begun in the 13th century) of the archbishop of the Swedish Lutheran Church, and the University, founded in 1477. In this same district are the celebrated iron-mines of Danemora, where the iron ore is perhaps the best in the world.

Götaland or "Gothland," south of Svealand, was the ancient home of the Goths, those blue-eyed yellow-haired giants of the north who wandered over so much of Europe and whose invasions started the overthrow of the western Roman Empire; thence, too, came many of the vikings who swept the seas in the 9th and 10th centuries. Götaland is the richest agricultural and industrial region of Sweden, fully three-fourths of its area being under cultivation and providing the chief industry of the country; and its frontage on two seas, with its many ports, makes it also the chief

maritime district. Outside of Stockholm, the largest centers of population are in this southern province—Göteborg, Helsingborg, and Malmö on the west coast, Karlskrona and Norrköping on the east coast, are all important cities. Malmö, the third largest city, is almost at the southernmost tip of Sweden and 16 miles straight east across the Sound from Copenhagen, the capital of Denmark.

The chief port of Sweden, and the second largest city, is Göteborg, whose commercial fleet of several hundred steamers carries iron, steel, and timber to the far corners of the earth. The total value of Sweden's exports amounts annually to several hundred million dollars, and a great part of this comes through the port of Göteborg. Here also splendid Swedish liners land direct from New York with their loads of summer tourists and returning Swedish-Americans revisiting the home land. In addition Göteborg is important as a railroad center and as the starting point of the famous Göta Canal, the great and important inland navigation system across southern Sweden, which connects Göteborg and Stockholm.

A TWO-WHEELED DRAY IN STOCKHOLM

A Swedish "truck" is usually a simple affair, drawn by a single horse. If he chooses, the driver may sit on his load, for there is no driver's seat, but usually he prefers to walk alongside. To load a two-wheeled conveyance of this kind takes some care, because an excess of weight at the rear might lift the horse right off the earth, like a seesaw.

The scenic route through the Göta Canal, occupying three days' time, is a favorite with tourists. Passing the gigantic and beautiful Trollhättan Falls, and climbing to a height of more than 300 feet above the sea and descending again, by means of 58 great locks, it traverses the great lakes of Sweden—Wenner, Wetter, and Mälar—between beautifully wooded hills and lovely pastures, with here and there an ancient castle, a picturesque red farmhouse, or a tiny village. But the Göta Canal is not merely a scenic route; it is a great artery of Swedish commerce, through which pass many thousands of vessels each year.

THE CHILDREN TAKE CARE OF THE LIVE STOCK

Many of the shepherds and goatherds of Sweden are young girls who are not strong enough to do heavy farm work. In almost every bit of pasture the traveler will find a youthful herder, serious and intent on her task. Goat's milk was formerly a staple food among the peasants, but cow's milk is now more commonly used, and herds of goats are not as large or as numerous as they once were.

Norrland, north of Svealand, is larger than the two other provinces combined. This is a region of great virgin forests, of high mountains, and considerable rivers, whose vast wealth in timber, iron ore, and water-power has only recently been developed. Here is Kiruna, more than 100 miles north of the Arctic Circle, a flourishing mining town with excellent schools, libraries, art exhibits, electric lights and trolley cars, which 20 years ago was not even on the map. Here we may sometimes see an encampment of Lapps with their herds of reindeer, though usually these queer timid people, who live in their reindeer tents the year around, will avoid the cities as much as possible, coming in only to trade their reindeer skins and hand-carved spoons and knives of horn for such necessary articles as sugar, flour, salt, and coffee (*see* Lapland). Close by Kiruna is Kirunavara, a mountain of iron which yields millions of tons of the finest ore each year. Since Lulea, the port on the Gulf of Bothnia, is closed

by ice during the winter months, most of this ore is sent by electric railroad over the mountains to the open Atlantic port of Narvik in Norway, whence it is shipped to all parts of the world.

Excellent railroads connect these far northern parts with the southern provinces, and at Boden, near the Finnish border, is the important junction with the Finnish Railroad. Being the military key to northern Scandinavia, Boden is strongly fortified; through this junction, at the outbreak of the World War in 1914, passed thousands of refugees of all nations, fleeing to their homes.

The many rivers of Norrland all rise in the mountains on the Norwegian border and extend in almost parallel lines east to the Gulf of Bothnia. Most of them are deep and navigable for 200 or 300 miles from the sea; they furnish excellent means of transportation for the timber cut on the mountains.

Its Wealth Drawn from the Soil

About one-half of all Sweden is covered with forests, and lumbering is, next to agriculture, one of the sources of greatest wealth to the country. In exports of timber and its products, Sweden ranks among the foremost countries of the world. Mining is the third industry in importance. Besides the iron mines, yielding great quantities of ore of the highest grade, there are copper, zinc and silver mines.

In addition to furnishing means of transportation, the rivers and lakes abound in valuable fish—trout, perch, pike, and salmon; and, most important of all, their many falls and rapids are capable of producing enormous water-power which the government is now converting into electric power for use in factories, illuminating cities, and driving trains. This is the more important because of Sweden's poverty in coal. The total horse-power of Sweden's waterways has been estimated at 6,200,000, of which 220,000 is furnished by the Trollhättan Falls, a series of picturesque cascades in southern Sweden.

The most important manufactures are wood products. Matches, furniture, wood pulp, paper, and wooden ware of various kinds are all produced in great quantities. There are also manufactures of porcelain and glass, iron and steel, and of textiles, besides flour and other food products, though not in sufficient quantities to supply the country's needs.

Agriculture the Chief Industry

In spite of the increase in manufacturing and other industries, nearly half the people are still engaged in agriculture, "the mother industry." Little of the land, however, is suitable for cultivation, only about 9 per cent being under crop. Oats, rye, and barley are the principal cereals, though there is also some wheat. Potatoes and sugar beets are grown in quantities, and the making of sugar is a thriving industry. Much live stock is also raised, and butter is exported to Great Britain.

Education in Sweden is free and compulsory, and she has excellent schools and colleges. Besides the State University at Upsala, there is another smaller State University at Lund, in Götaland, as well as other higher institutions of learning at Stockholm and Göteborg. The Swedes are a highly cultured people, delighting in art, literature, and music. They have a special aptitude for scientific pursuits and have produced some famous scientists; the best known are perhaps Linné (*Linnaeus*) the botanist, famous for his classification of plants and animals, and Alfred Nobel, the inventor of dynamite, who left his fortune to establish five annual prizes to those who had contributed the greatest service to mankind in the fields of physics, chemistry, medicine, literature and peace (*see* Nobel Prizes).

In 1909 universal suffrage, without restrictions of property or income, was granted to all men 25 years of age or over; and ten years later (1919) the same privileges were extended to women. Sweden is famous for the "Gothenburg (Göteborg) system," under which the manufacture and sale of intoxicants are in the hands of the municipalities, with the design of checking their excessive use. The government is a limited hereditary monarchy, with a king, a cabinet and a parliament or Riksdag, consisting of an upper house of 150 members and a lower house of 230 members. As in the other Scandinavian countries, Lutheranism is the state church, to which more than 90 per cent of the people belong, though other religions are tolerated. (*See also* Scandinavia.)

Sketch of Sweden's History

Lapps and Finns are met with in Sweden at an early date, and about the beginning of the Christian era the Goths dwelt there also. But, like Denmark and Norway, the land was first organized as a state by the Scandinavian "Northmen," who were the terror of Europe in the 10th century. Christianity was not fully established until about the year 1000. Sweden united with Norway and Denmark in the Union of Kalmar in 1397, but about 125 years later it revolted under the leadership of Gustavus Vasa against Danish rule and became an independent kingdom. Under Gustavus Adolphus, in the early 17th century, the country became one of the great powers of Europe (*see* Gustavus Adolphus). It championed the Protestant cause in Germany in the Thirty Years' War; and wrested territory from Russia, Poland, and Prussia, so that it became the mistress of the Baltic, ruling the eastern as well as western shore of that sea. But collapse came in the 18th century under Charles XII and after. For a time this boy-king was able to hold off his enemies, Russia, Poland, and Denmark. But in 1709 the ascendancy of Sweden was lost by the defeat of Charles XII by Peter the Great at Poltova, in southern Russia (*see* Charles XII). Little by little her conquests were taken from her. In 1810 one of Napoleon's marshals, Bernadotte, was elected crown prince and the present reigning Swedish house is descended from him. In 1815 Finland, ceded to Russia in 1809, was definitely taken from Sweden and given to Russia; but by way of recompense Norway was joined to Sweden in

STOCKHOLM, "VENICE OF THE NORTH"

Although Stockholm has often been called the "Venice of the North," because it is built partly on islands, in appearance it is quite different from the island city of Italy. Stockholm's islands are rocky and wooded, with narrow quiet waterways between them. The photograph shows the northern part of Staden, the ancient nucleus of the city, now an island in the central part. In the distance, on the left bank of the river, is the great rectangular pile of the Royal Palace, a handsome building in the style of the Italian Renaissance, a strange link between this cold Scandinavian Venice and its sunny sister city of the South.

personal union under the Swedish king. In 1905 the Norwegian parliament declared this union dissolved and chose a king of their own. The Swedish king Oscar II protested but accepted its decision. Upon the death of Oscar II in 1907 his son Gustavus V became the reigning sovereign.

SWEET PEA. No summer garden is really complete without the fragrant many-colored butterfly blossoms of

> Sweet peas on tiptoe for a flight
> With wings of gentle flush o'er delicate white.

And because of their beauty and fragrance and the ease with which they may be cultivated they are general favorites in greenhouses as well.

Sicily and far-away Ceylon are the native lands of our present garden race of sweet pea. An old Italian monk was its first cultivator, the story goes, and somewhere around the year 1699 sent seeds of it to England and elsewhere. In the last part of the 19th century English florists experimented with the plant and bred many varieties of beautiful colors and remarkable size. Later still America began experimenting too, and owing to the successful work of California seed-growers, who produce most of the world's supply, the number of named varieties is now legion.

The sweet pea's scientific name is *Lathyrus odoratus;* it belongs to the pea family (*Leguminosae*). The blossom has five petals; the upper or odd one, which is larger than the others and encloses them in the bud, is called the standard. Stem rough, hairy; pods from one to two inches long.

SWEET POTATO. On the world's dinner table the sweet potato is the vegetable ranking next in importance to the white or Irish potato. (*See* Potato.) The natives of tropical America were feasting upon sweet potatoes before the coming of Columbus, and the inhabitants of the tropics of both hemispheres had very early discovered that sweet potato roots were a delicious food.

The sweet potato is not, as you may think, in the same family with the "Irish" potato. It is a creeping vine closely related to the common morning-glory, and its edible tubers are roots, while those of the Irish potato are underground stems. Both roots and stems store up nourishment, and the sweet potato makes the better selection of foods, storing up more sugars and fats along with the starch. Indeed the sweet potato produces more pounds of food per acre than any other plant, and in the amount of real nourishment per acre it ranks next to corn. While sweet potatoes do not keep as well as the Irish potato, they are marketed fresh practically throughout the year, as well as in cans.

The sweet potato thrives best in a warm climate, but they can be grown wherever there is a growing season of four months free from raw winds and frost. They are grown best in loose sandy loam that is well drained. After they are well started they need little moisture. New plants are obtained by planting the roots in a root bed, and when sprouts are formed they are pulled and transplanted to the field. Usu-

ally three sets of sprouts may be gathered from the same bed. In the United States, they are a favorite crop in the South but are cultivated as far north as New Jersey.

Sweet potatoes of the yellow-fleshed variety are called yams by the Southerners, but the true yam is a root tuber belonging to an entirely different family, although very much like the sweet potato in composition and manner of growth. The yam originated in China. It is grown in European countries but not to any great extent in the United States. The yam is hardy and wholesome, but its tubers are grown so deep in the soil that they are dug with difficulty.

Scientific name of the sweet potato, *Ipomoea batatas*. The yam is any one of several species of *Dioscorea*.

SWIFT, JONATHAN (1667–1745). To most persons Jonathan Swift is known only as the author of 'Gulliver's Travels', a book much read by children for its lively adventures. The story, however, was written with a far more serious purpose than that of mere amusement. It was meant as a satire, to lay bare the faults of "that animal called man," as Swift said in a letter to the poet Pope. If one understands 'Gulliver's Travels', one gains an insight into Swift's whole character and purpose.

Swift was born in Ireland of English parents, and was educated at Trinity College, Dublin. He was dull and unhappy in college and showed few signs of the genius which he later displayed. When he was 20 years old he became under-secretary to a retired English statesman, Sir William Temple, and spent much of the next ten years on his patron's estate in England. Swift's work was not of a kind to employ fully his time, and he used his leisure to do a great amount of reading and to write several books which laid the foundation of his literary reputation.

Preaching to a Congregation of One!

Shortly before his patron's death he became a clergyman of the Church of England, and was soon appointed to a church in Ireland, near Dublin. Because most of the Irish people are Catholics, his congregation never consisted of more than 15 persons and often when only he and the parish clerk were present Swift would begin his sermon with the words, "Dearly beloved Roger."

But this position gave Swift enough money to live on, and from time to time to visit London. There he became intimate with the leading literary men of that day. These included Addison and Steele, the authors of the delightful essays entitled 'The Spectator'. Swift became well known, too, in English political circles. He allied himself with the Tory party and wrote brilliant political pamphlets in defense of its policies. He soon became a power to be reckoned with. The Whigs feared the lash of his satire and the Tories feared to lose his support; so he was courted and flattered, with the result that he became unbearably arrogant.

As a reward for his services Swift was made dean of St. Patrick's Cathedral in Dublin. He now identified himself with the protest against English tyranny in Ireland. In order to call attention to the miserable poverty of the Irish people, he wrote a pamphlet called 'A Modest Proposal for Preventing the Children of Poor People from being a Burden to Their Parents or the Country'—the remedy being to kill and eat the Irish children!

That ridiculous proposal is typical of Swift's method of fighting wrong. In 'Gulliver's Travels' he shows us the spectacle of candidates for high government offices dancing on the tight-rope, the former winners of high places being forced to perform from time to time or lose their appointments.

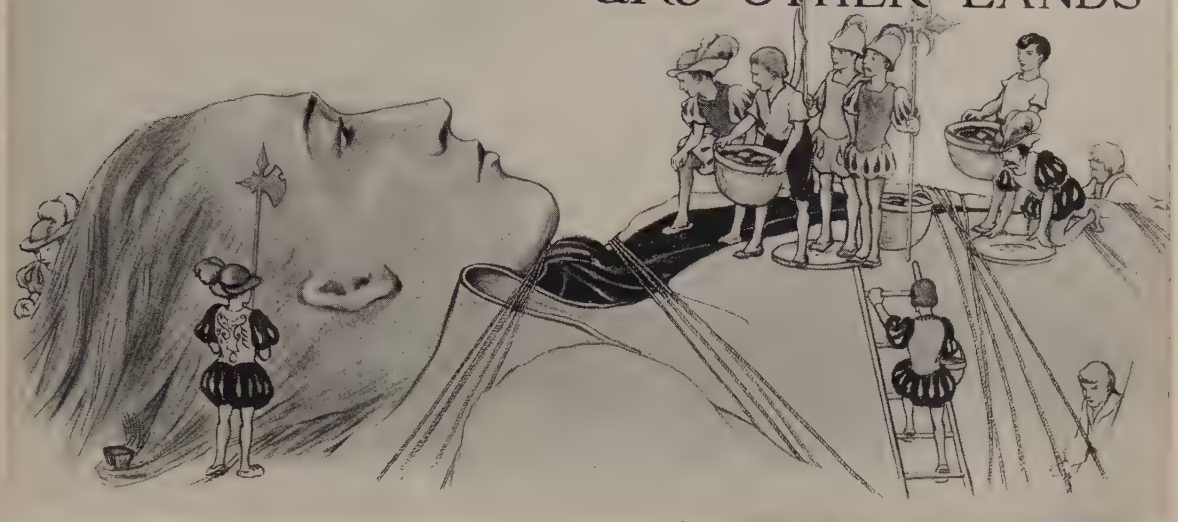
It is evident from Swift's life that he used his skill in writing as a means to an end—as a correction of abuse. Whether he is trying to relieve distress in Ireland, or is directing his jibes against the ladies "who out of zeal for religion have no time for prayers," or at the corruption of politicians—in every case he matches folly with folly. In other words, he is a satirist—the greatest of his time, and one of the greatest of all times.

Swift's Two Love Affairs

The bitterness of Swift's writings was due in part to the disappointments and bitterness of his life. The brightest and the darkest spot was his love for the lady whom he calls "Stella." He first met her (her real name was Esther Johnson) while he was a member of Sir William Temple's household and she was a little girl eight years old. He taught her how to write and gave her advice as to her reading, and a tender friendship sprang up between them which lasted for many years. His 'Journal to Stella' which has delighted thousands of readers, records the most intimate side of his life, as well as his gossipy comment on men and events. Whether or not Swift married Stella is not known; at any rate they never lived together. Stella was rivaled in his affections by another young woman named Esther Vanhomrigh ("Vanessa"). To both these devoted women Swift caused great unhappiness, though there is a veil of mystery about this part of his life which makes it uncertain how much blame should attach to him. Vanessa died of a broken heart in 1723, and was followed five years later by Stella. Swift's remorse undermined his health of body and mind. A malady from which he had suffered almost all his life finally overcame him, bringing insanity and death. Yet during the interval between the deaths of Stella and Vanessa, Swift reached the height of his popularity and fame. He was especially liked by the Irish for his rasping criticisms of the English misgovernment of Ireland. And then he crowned his work in 1726 by the publication of Gulliver's Travels, a book so profound in its satire on human nature, and so diverting in point of narrative, that it has instructed and amused both old and young for two centuries.

Swift's chief works were: 'Tale of a Tub' (1704); 'Battle of the Books' (1704); 'Drapier's Letters' (1724); 'Gulliver's Travels' (1726); 'Journal to Stella' (written between 1710 and 1713).

GULLIVER'S VISIT *to* LILLIPUT *and* OTHER LANDS



WHEN the good ship *Antelope* was wrecked during a dreadful storm in the South Seas, the only person saved—according to the story told in Dean Swift's fascinating book—was Dr. Gulliver, the ship's physician. After swimming about for hours he was washed up on the warm sandy beach of an island.

Worn out by his long struggles against the waves he fell asleep at once, and when he awakened nine hours later—he couldn't move an inch! He was tied fast by a perfect network of little cords, attached to tiny pegs driven in the ground. Even his long hair—for men wore their hair in long queues at that time, over two centuries ago—was securely fastened down, so that he could not move his head.

Presently he felt something moving on his left leg. As it advanced over his breast almost to his chin, he perceived it to be a human creature, not six inches high, with a bow and arrow in his hands and a quiver on his back. About 40 more of the same kind followed the first. In his great astonishment Gulliver roared so loud that they all ran back in fright, and some of them had bad falls in their haste to jump off his body. When he struggled to free himself, they shot tiny arrows at him, which pricked his hands and face like so many needles.

The Lilliputians—for it was to the land of Lilliput that he had come—were good little people after all. Gulliver could not speak their language, but he pointed to his mouth and stomach, and made them understand that he was hungry. So a ladder was set up against his shoulder and a hundred little people climbed up and down and filed past his mouth. They fed him whole legs of mutton smaller than the wings of a lark and loaves of bread as large as musket bullets. It took 900 of their best soldiers to lift the Man-Mountain—as they called him—onto a low truck with wheels, drawn by 1,500 Lilliputian horses. They put him in a temple in the city. The Emperor's smith then brought fourscore and eleven chains, like those that hang on a lady's watch chain in Europe, and locked them to his left leg with six and thirty padlocks. Over a hundred thousand people came to see him, for Dr. Gulliver was a greater curiosity to the Lilliputians than a whole zoo full of wild animals would be to you.

Presently the Emperor himself came on horseback with his court and viewed the Man-Mountain with great admiration. He ordered his cooks and butlers to prepare food for him, and ordered 600 beds to be brought to the temple. Seamstresses and tailors sewed these together, using 150 of them for the length and breadth of Gulliver's bed, and placing them four beds deep. By the same computation they sewed together sheets, blankets, and coverlets.

When the Emperor left, he had a guard stationed about the temple to protect the Man-Mountain from the impertinence of the rabble. Some of the Lilliputians, indeed, had the boldness to shoot their arrows at him as he sat on the ground, and he tells of the incident thus:

"One arrow very narrowly missed my left eye. But the colonel ordered six of the ringleaders to be seized, and thought no punishment so proper as to deliver them bound into my hands, which some of his soldiers accordingly did, pushing them forward with the butt ends of their pikes into my reach; I took them all in my right hand, put five of them into my coat pocket, and as to the sixth, I made a countenance as if I would eat him alive. The poor man squalled terribly, and the colonel and his officers were in much pain, especially when they saw me take out

my penknife; but I soon put them out of fear; for looking mildly, and immediately cutting the strings he was bound with, I set him gently on the ground and away he ran. I treated the rest in the same manner, taking them, one by one, out of my pockets, and I observed both the soldiers and people were obliged at this mark of my clemency, which was represented very much to my advantage at court."

Gulliver soon gained such favor that, after he had sworn a peace with the Emperor and his kingdom, the chains were removed from his ankle, and he was allowed to wander at will through the kingdom. In return for his freedom he promised to give the people warning of his approach, that they might keep off the highway and not run the risk of being stepped on. He likewise promised never to lie down in a field of grain, and to use the utmost care not to trample upon the inhabitants or their property.

GULLIVER A PRISONER IN LILLIPUT

"It took 900 of their best soldiers to lift the Man-Mountain,—as they called him—onto a low truck with wheels, drawn by 1500 Lilliputian horses."

Gulliver made rapid progress in learning the language of the kingdom and in acquainting himself with its peculiarities. He found that everything was in proportion to the size of the inhabitants. He marveled much at the sharpness of sight which enabled a cook to dress a lark no bigger than a fly, and a young girl to thread an invisible needle with invisible silk. One of their customs which he found most interesting was that of burying their dead with their heads downward. This was done because of the belief that in eleven thousand moons the earth would turn upside down, and the dead would rise again; by this means of burial they would all be standing on their feet when they again came to life.

The Politics of Lilliput Land

He discovered that in Lilliput, as in other lands, there were political parties, and that some time before his coming the Lilliputian "Big-Endians," a party whose members insisted upon breaking their eggs at the big end when the court edict commanded that all faithful subjects should break them at the small end, had been exiled from the kingdom. He learned, also, that there were then in Lilliput two struggling parties, named "Tramecksans" and "Slamecksans," from the high and low heels of their shoes. The low-heeled party was in power, though the Crown Prince was thought to have a tendency toward the high heels; it could be easily seen that one of his heels was higher than the other, which made him hobble.

You may well imagine that Gulliver was a lot of trouble to the Lilliputians. They didn't know what to do with such a Man-Mountain. He ate so much that he nearly brought on a famine. He wanted a boat to go away in, but they never could have built one big enough with the tiny trees in that country. So he had to stay, and he tried in every way that he could to make himself useful to the kingdom.

Now it happened that about 800 yards northeast of Lilliput lay another island ruled by the Emperor of Blefuscu. When the Big-Endians were exiled from Lilliput they found refuge in Blefuscu, and for six and thirty moons there had been war between the two empires. Just at this time the Blefuscudians had prepared a great fleet to invade Lilliput, and the Emperor of Lilliput asked Gulliver's assistance.

First Gulliver spied upon the enemy's fleet across the channel through his pocket telescope. Then he made some rope out of cords, and got some iron bolts and stout hooks, and with these he waded and swam across the channel that separated the two islands. The little people of Blefuscu jumped out of their ships and swam ashore when they saw this Man-Mountain walking through the sea. About 30,000 of them gathered upon the shore and discharged arrows at him, but Gulliver protected his eyes with a pair of spectacles and received no harm. Fastening his hooks in the prows of their war ships, he cut the anchor cables, gathered up his ropes, and splashed back again, pulling behind him the whole Blefuscudian fleet.

Of course Dr. Gulliver was the hero of the Lilliputian people, and the Emperor gave him the title of Nardac, which means "grand duke." But really he had only got himself into deeper trouble by his feat. The favor shown him made enemies for him at the court, and the Emperor was displeased because Gulliver would not go back to Blefuscu, conquer the country and make it a province of Lilliput. Moreover

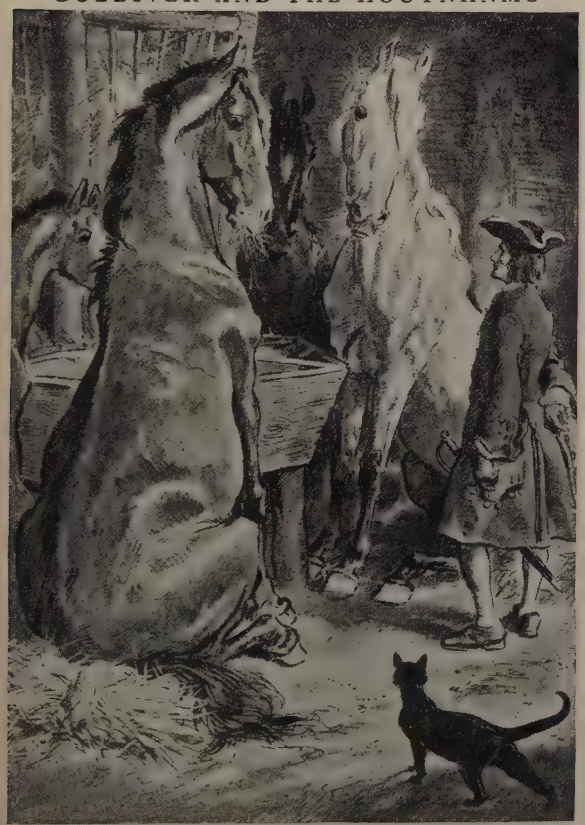
while peace was being negotiated, Gulliver was so indiscreet as to become quite friendly with the ambassadors of Blefuscu, who invited him to pay their country a friendly visit. His greatest enemies wished to put him to death while he slept. But as a mark of the Emperor's mercy, it was secretly decided that Gulliver should only have his eyes put out, and then gradually be starved to death.

Fortunately Gulliver was warned of this sentence by a friend who came to him at dead of night. By acting promptly, he escaped across the channel to Blefuscu, where he was kindly received.

Presently he found a full-sized ship's boat afloat, from a wrecked ship, near the shores of Blefuscu. This he equipped with oars and sail, and food and water. Finally, with the good will of all the Blefuscudian people, he set sail for his own land. After several days he was picked up by an English sailing vessel; and it was not many weeks before he was landed safe once more in London.

On his next voyage Gulliver had another adventure quite as strange as his visit to the land of the Lilliputians. This time he was left by some sailors on the island of Brobdingnag, inhabited by a race of giants. These monsters looked as tall as steeple

GULLIVER AND THE HOUYNHNMS



"The horses, or Houynhnms, he found far superior to man in their ideas of justice, honor, and courtesy. When Gulliver learned their language he told them something of affairs in England."

THE INHABITANTS OF LAPUTA

"One of these voyages took Gulliver to a floating island called Laputa, inhabited by a queer race, with heads all inclined either to the right or left, and with one eye turned inward and the other upward."

spires and they covered about 10 yards at every stride. They had to take Gulliver up between a thumb and finger and hold him about 60 feet from the ground to look at him. Their cats were three times the size of an ox. Some of the dogs were equal in bulk to four elephants, and the rats were the size of large mastiffs. Everything in the land was in the same proportion.

Dean Swift gives an account of two other voyages made by Gulliver. One of these took him to a floating island called Laputa, inhabited by a queer race, with heads all inclined either to the right or left, and with one eye turned inward and the other upward. On the fourth voyage he found himself in the land of the Houynhnms, where a wonderful race of horses lived and had as servants and slaves a very inferior race of human beings, called "Yahoos."

The horses, or Houynhnms, he found far superior to man in their ideas of justice, honor, and courtesy. When Gulliver learned their language he told them something of affairs in England. They had never heard of the art of war, and thought only persons of very little reasoning power could be capable of such enormities. They did not know the meaning of a lie, for they argued that the use of speech was given us to make us understand one another and to

receive information of facts; so, if anyone said the thing that was not, these ends were defeated. They knew nothing of the use of money, and when anyone of them was short of supplies his neighbors contributed whatever was needed. Thus, in a thousand ways, Gulliver found these animals far superior to the race of man, and on returning home from this last voyage he became filled with contempt at the vices and follies of his fellow humans.

—*Retold from Swift's 'Gulliver's Travels'.*

SWIMMING. It is said that all living creatures, except men and monkeys, can swim by instinct. But, in this respect, men have one advantage over monkeys—they can learn as an art what they lack as an instinct. Any normal human being can acquire the art in a short time, if he sets about learning it in a proper manner.

The first thing to remember is that the average human body, when there is air in the lungs, is slightly lighter than fresh water, and considerably lighter than salt water. Nearly everyone can "float" motionless in a horizontal position with face above the surface if the body is properly balanced. And even when the body is upright a slight effort is sufficient to keep the head well clear of the water.

These considerations will help the beginner to overcome the fear of sinking—the chief difficulty in learning to swim. The first thing to do, therefore, is to go into calm water well up to your shoulders, and slowly raise your feet off the bottom, making at the same time short downward motions with your hands. The hands should be held back close to the body, with palm and fingers extended on the down stroke, but drooping under on the up stroke. Bear in mind that it is only necessary to keep the mouth and nose above the surface, and make the hand motions as deliberate and free from muscular strain as possible. Next, experiment with a treading motion of the feet, thrusting down each foot in turn with sole flat, and drawing it back with toes downward.

Once you are able to keep afloat in this manner for a few seconds, you are ready to begin learning the simpler swimming strokes. It is essential to practice these strokes properly from the beginning, otherwise you will form makeshift habits which will prevent your becoming a good swimmer. Above all things train yourself to take your strokes steadily and smoothly, and learn to relax in the water. The tendency of all beginners is to keep their muscles rigid, stiffening the body, as well as the arms and legs, and that is why they tire after a few strokes.

The Breast Stroke. This is the simplest of all strokes. The hands are brought together, palms down, in front of the chest and pushed out straight ahead to the full length of the arms; then the palms are turned outward and the arms swept back horizontally. The stroke is finished by bringing the hands together under the chest again. For the leg-stroke, the knees are first drawn up under the body; then the legs kick out backward and wide apart, are brought together again like scissor blades, and drawn up once more for the next stroke. The backward kick of the legs should be timed to come as the arms are being thrust forward. These movements may be practiced before entering the water by lying across a chair seat or on the edge of a bed.

The Side Stroke. This stroke is valuable as a preparation for the faster racing strokes. The body is turned on one side, and the arms, instead of working together, alternate in their movements. As the lower arm sweeps downward and backward, the other arm reaches forward, skimming the surface of the water, and then moves downward and backward in its turn. The legs are drawn up and thrust out to much the same position as if you were taking a long step, then they are brought together again with a scissors motion.

A variation of this stroke which gives greater speed is performed by reaching far over the head with the uppermost arm, and at the same time allowing the face to sink beneath the surface. The face emerges again as the lower arm is thrust forward.

This stroke requires a careful timing of the breath. Inhale on the forward thrust, and exhale on the power stroke, while the face is under water. As far as possible all breathing should be done through the mouth, as this not only permits more rapid action but minimizes the danger of inhaling water into the lungs.

The Trudgen. This stroke is performed while lying flat upon the water, as near the surface as possible. The arms are used alternately with a wind-mill motion, remaining extended nearly to full length throughout the stroke. Each arm sweeps outward and forward above the water, plunging in when straight ahead, and sweeping back straight down under the body. The face is kept well down in the water, except when a breath is necessary. Then the body rolls slightly to one side, the head turning to get the mouth clear, as the arm on that side finishes its stroke. The leg motion may be a rapid modification of that used in the breast stroke, or it may be the movement described for the "crawl."

The Crawl. This is the fastest and most violent of all swimming strokes. The hands instead of making the long half-circle sweep of the "trudgen," are shot straight forward in turn close to the body and head, and plunge into the water with a downward diving movement, sweeping back with a rapid half-arm stroke along the sides. The upper part of the leg is held motionless, knees together, while the legs below the knees move rapidly up and down, threshing the water with a walking motion. Breath is taken when necessary by lifting the face from the water for an instant.

Diving. This is an art in itself, which can only be acquired by constant practice. "Sloppy" diving is usually caused by drawing up the knees or allowing the feet to flop over as the body enters the water. Or perhaps, out of an instinctive fear of falling head first,

SOME AIDS TO SWIMMING AND DIVING

These pictures show some of the positions assumed in the various swimming strokes, dives, and water tricks. In connection with the directions in the text they will be of service to the beginner. Most of them are clear enough without explanation. The "crab-stroke" for swimming sideways consists of a motion very much the same as if you were walking sideways on your hands and knees; the "nautilus" requires a sculling motion with the hands to keep the weight of the upraised leg from forcing the body under water. In making the "Swiss dive," the body is allowed to tip forward rigidly and without a spring from a sufficiently high diving board. The "racing dive" is used at the beginning of a race, the body striking almost flat on the surface of the water, with the arms in position for the first stroke.

contained in the Easy Reference Fact-Index at the end of this work

the diver strikes the water flat, perhaps with painful consequences. For plain diving, the body should follow the line of a curve such as would be made by a stone tossed out a similar distance into the water. The hands should be held over the head with thumbs together and palms down, never with palms together. As the body enters the water, it should be straight, toes pointed backward. When the body is about half-way in, the hands should be bent upward at the wrist, which will tend to bring the head quickly to the surface and a chance to breathe.

Life Saving. All swimmers should learn how to save persons from drowning. To avoid being seized and pulled down by the frantic victim, the rescuer should approach from the rear, thrust the crook of one elbow around under the chin of the drowning person and tow him backward to safety, making the swimming strokes with the legs and the free arm.

MAJESTIC mountains thrusting jagged snow-crowned peaks into the sunlit sky; a thousand blue crevassed glaciers from which sparkling rivers flow to make lakes of wondrous loveliness; broad smiling valleys filled with waving fields, and busy cities in which are sold the products of matchless technical skill; a people kindly, intelligent, picturesque in costume and custom. These help to make Switzerland indeed "the playground of Europe" and "an Alpine battery against oppression."

SWITZERLAND. Tucked in between Germany, Austria, Italy, and France, without any sort of proper geographical unity; with an area about twice that of the state of New Jersey (15,950 square miles), and a population only slightly larger than that of this American commonwealth (3,850,000); Switzerland shows by its 600 years of heroic history that there is a real need in Europe for its existence. It is for the general political good that this Alpine land should be occupied by a small state, which shall have nothing to do with the wars of the greater powers surrounding it. So, for their own sake—to guard against treacherous attacks, one on another, through Switzerland—the powerful neighbors of this little mountain republic have joined since 1815 in guaranteeing it perpetual neutrality. But the Swiss do not rely too much on treaties which may at need prove only "scraps of paper"; and all through the World War of 1914–18 their mobilized army of sturdy citizen-soldiers defended the frontiers against all temptation of the warring powers to find a short cut to success through their forbidden paths.

In outline Switzerland is somewhat like a great armadillo or other curious monster — with the Austrian Tyrol touching its head, the Upper Rhine and Lake Constance forming the shoulders and back, the Jura Mountains and Lake Geneva defining an abbreviated tail in the west, and the main ridge of the Alps forming part of its irregular under side, which vaguely suggests creeping feet. Switzerland, however, is far from being all Alpine peaks and mountain valleys. The northwestern half, which makes up the "plateau" of Switzerland, is composed almost entirely of the rolling valleys of the rivers Aar and Thur, tributaries of the Rhine; and it is only the southeastern half that is preëminently mountainous. Only about one-fourth of the country is unproductive, including mountain peaks, glaciers, lakes, and rivers. But little of the productive area is suitable to agriculture, and Switzerland is largely dependent upon other

countries for its supplies of grain, devoting its own land mainly to pastures. Owing to the demand for wider areas of agricultural land, the country is today reduced in timber resources.

The wondrous "mountain glory" of Switzerland can best be felt in the highest Alps, which make up or are near the southwestern boundary. Here is Mont Blanc (15,782 feet) with its snow-crowned heights rising from French soil about eight miles over the border; the Matterhorn (14,780 feet), that towering pyramid of solid rock whose precipitous heights would seem to defy the boldest Alpine climber—but which nevertheless has again and again been scaled; Monte Rosa (15,217 feet), with its far-spreading mass of snow and ice, set squarely on the Italian frontier; and a score of other peaks whose awe-inspiring grandeur prints memories never to be forgotten on the mind of the beholder. Some 20 miles beyond Monte Rosa is the great Simplon tunnel, 12¼ miles long—the longest tunnel in the world—affording one of several routes by which trains pass from Italy into Switzerland across the great mountain barrier.

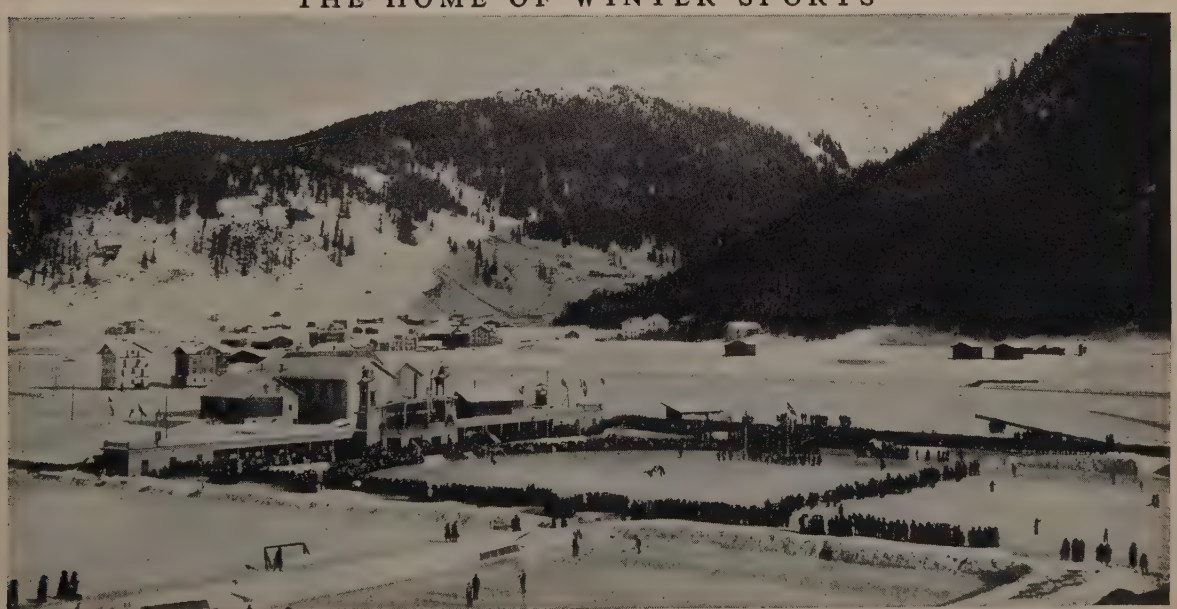
A STURDY BURDEN-BEARER

The women of the Saas Valley, in the French-speaking canton of Valais, are noted for their constant use of tobacco, no less than for their great strength.

For sheer joy and mountain loveliness, one must turn northward, cross the valley trough—occupied by the upper courses of the Rhone on the west and the Rhine on the east—and enter the second chain of the Alps, running parallel from southwest to northeast, to the main range. Here, in the Bernese Oberland, the chaste crystal spires of the Jungfrau (13,670 feet), and the shining peaks of the Mönch, Eiger, Aletschhorn, and Finsteraarhorn—to name but a few—stand above green valleys, at watch over sparkling glaciers or dainty toy villages. Their thick clustered snowtops almost equal in height the giants of the main range, and the glory of the panorama which they form is unequaled in Europe.

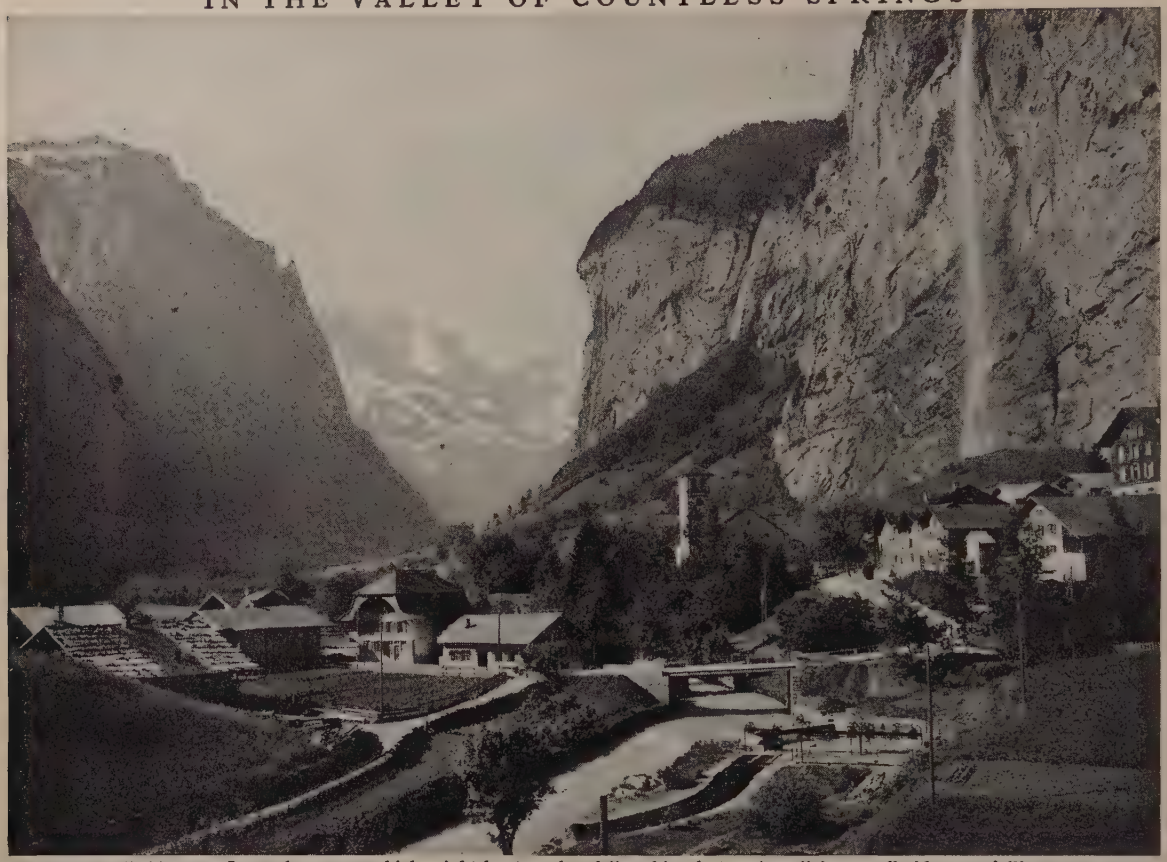
Four rivers flowing into four distant seas either rise in Switzerland or receive important tributaries from within its boundaries. The Rhine, whose source in central Switzerland lies at the foot of Mount St. Gotthard—famous for its railroad tunnel nearly ten miles long—after cutting across the eastern face of Switzerland, forms part of both the eastern and north-

THE HOME OF WINTER SPORTS



The winter sports of Switzerland are centered in the resorts of Davos, St. Moritz, and Pontresina, all in the Engadine Valley. There, 6,000 feet above the sea, with snowy peaks on every side, enthusiasts come from the four corners of the earth for skating, snow-shoeing, and tobogganing. This ice rink at Davos is said to be the largest in Europe, and is divided into various sections, some of which are reserved for games and fancy skating. Davos, which is situated in a beautiful valley at an elevation of 5,100 feet above sea-level, was for many years the home of the English critic and poet, John Addington Symonds, and was for two winters Robert Louis Stevenson's refuge from ill-health.

IN THE VALLEY OF COUNTLESS SPRINGS



The Swiss call this town Lauterbrunnen, which might be translated "nothing but springs," for on all sides are falling waters, cascades, cataracts, and rivers, as if the valley were indeed alive with springs. The waterfall at the right is called the Staubbach (Dust Brook), so named because its spray, like a fine dust, fills the air of this beauty spot. In the distance, between the two dark rock masses drawn back like curtains to disclose the chief actor on the stage, is the Jungfrau, the queen of the Alps, whose rosy tinted snows, like the blush of a youthful maiden, have inspired the name. Not so grand as the Matterhorn, the Jungfrau is one of the loveliest of all Alpine peaks.

ern boundaries before turning sharply at Basel on its journey to the North Sea. Its great tributary, the Aar, is also the chief stream of western Switzerland. On the opposite side of St. Gotthard lies the glacier whence issues the river Rhone, flowing westward down a charming valley to Lake Geneva, and thence through France to the Mediterranean—on the other side of Europe from the Rhine's mouth. From the southern slopes of St. Gotthard the Ticino River runs into Lake Maggiore, thence through Italian soil into the Po, and so into the Adriatic. Last of all, the lordly Danube receives from the Engadine valley of eastern Switzerland the waters of the River Inn, to discharge them, a thousand miles away, into the Black Sea. A circle 60 miles in diameter includes headwaters of all these four streams, so distant at their mouths.

The great mountain ranges which give Switzerland its character are of comparatively recent formation, being of the same general age as the American Rockies. They lie in four zones, running roughly from southwest to northeast. The northernmost is the Jura region, of folded limestone. Then comes a sandstone plain. The third zone contains a confused mass of mountains, chiefly of limestone. The fourth and southernmost zone consists of the towering granite and gneiss masses of the Southern Alps. The mineral contents are few, asphalt, salt, iron, and anthracite being found in small amounts.

The whole surface of Switzerland glimmers with lakes of surpassing loveliness. At the northeastern and southwestern corners are lakes Constance and Geneva, already mentioned, each about 40 miles in length by 8 to 10 in breadth. Lakes Neuchâtel and Bienne, in the western plateau, are smaller; as are also the mountain rimmed lakes of the center—Zurich, Zug, Lucerne, Thun, and Brienz. Switzerland has 14 lakes, each more than four square miles in area. On the Italian border lie lakes Maggiore and beautiful Lugano, and just across the frontier in Italy—most imposing and exquisite of all—is villa-crowned Lake Como.

A History Crowded with Heroic Deeds

Under heavy odds the Swiss have won for themselves their place as one of the peoples of Europe. The three "forest cantons" of Uri, Schwyz, and

A LAND WHOSE CHIEF INDUSTRY IS CARING FOR TRAVELERS

Like many good things, Switzerland is small. Three Switzerlands could be set inside the state of New York, and all the people of Switzerland could be housed in New York City. The perpetual neutrality and independence of this little country have been guaranteed by its great neighbors, none of whom wants any of the others to rule this fair land.

Unterwalden—to the north of Mount St. Gotthard—were the first to throw off their feudal subjection to the neighboring counts of Hapsburg and bind themselves in a "Perpetual League," in 1291. Though legend has much to say of William Tell in these events, history proves him a pure myth. In the battle of Morgarten (1315) the confederated peasants—armed with lances made by tying their scythe-blades to alpenstocks—not merely withstood the armored knights of the Hapsburgs, but laid the foundations of a military system which made the Swiss pikemen for exactly 200 years the most renowned and sought-after foot-soldiers of the continent. Subsequent victories confirmed their freedom—at Sempach in 1386, where brave Arnold von Winkelried gathered the lances of the enemy into his own bosom to save his comrades; and on that winter day in 1477 when haughty Charles the Bold of Burgundy was left slaughtered, despoiled, and frozen in the marsh at Nancy. The independence of the Swiss cantons—grown to 13 by that time—was formally confirmed in the treaty of Westphalia in 1648; and in 1815 the Congress of Vienna guaranteed their perpetual neutrality. At the same time the number of the cantons was increased to 22 by the formal accession of Geneva, Neuchâtel, and other districts.

Not merely does Switzerland lack geographical unity—it lacks as well unity of race, of language, and of religion. In most of the cantons, including all the earlier confederates, German is the language of the people. But in five western cantons French is the common language, and in one canton in the south (Ticino) the people speak Italian. In one canton (the Grisons) the old dialect called "Romansch"—derived from the ancient Latin of the people—is still in everyday use. The flourishing cities of Zurich (under Zwingli) and Geneva (under Calvin) were influential centers of the Protestant Reformation, but in more than half of the cantons today the Catholic religion prevails.

The rural Swiss are marvels of thrift, forcing out a livelihood from the slimmest strip of valley soil, and living for generation after generation in the same trim picturesque ginger-colored houses, or "chalets." Grapes for wine are raised on the sunny slopes of the Jura and the Alps, and considerable quantities of fruit are grown. Grazing and dairying, however, form the chief support of the people. In summer they make a village holiday of moving their cattle from the lower to the higher pastures for the sake of the sweeter, fresher grass; and in winter the famous Swiss cheeses ripen in the cellars during the great Alpine storms. The rivers and streams, which are carefully controlled to prevent floods, at the same time irrigate the Swiss meadows, which in spring are bright with flowers. The women make beautiful embroideries to swell the family savings, and the men toil up and down the mountain heights as hardy guides for parties of mountain climbers.

No such placid dreamy spirit lies over Swiss cities. Of these there are about 30 with more than 10,000 people—Zurich, Basel, Bern (the capital), St. Gall,

and Lausanne being the largest. Their clean streets and well-kept walks and parks stream with foreigners, and the tourists, their guides, and their mountain climbing paraphernalia are everywhere. Switzerland's miles upon miles of splendid roads, leading over the mountain passes into every picturesque valley, make the land a paradise for motoring; and the efficient government-owned railways, and the rack-and-pinion lines which now ascend most of the important mountains make sightseeing easy for the non-athletic and poor in purse.

Brisk Sports of Winter Time

Of late, skiing, tobogganing, and other winter sports have attracted nearly as large crowds as the more smiling summer season. History with its deep charm, for the imaginative traveler, clings also about many Swiss cities—such as Geneva, where walk the ghosts of stern John Calvin, brilliant Mme. de Staël, the revolutionist Jean-Jacques Rousseau, and skeptical Voltaire. Americans take thought of the past in the canton of Zurich, whence in 1710 came large numbers of religious refugees to settle in Pennsylvania and swell the numbers of the so-called "Pennsylvania Dutch." Not only past but present-day historical figures play out their drama here. Switzerland has long been a refuge for political and other refugees from other lands, and since the World War many deposed kings, outcast nobles, and unsuccessful revolutionists of every hue have found asylum there.

Caring for tourists is the leading industry, but Switzerland bustles with manufactures of every sort. At Geneva, Bern, Neuchâtel, Chaux-de-Fonds, and Locle are made the famous Swiss watches and clocks, with jewelry and tinkling music boxes as an added line for some of them. Zurich, Basel, St. Gall, Glarus, and Appenzell hum with the textile industry. Emmenthal and Gruyère make Swiss cheese, and Swiss chocolate and condensed milk come chiefly from Vevey. In many Swiss mountain hamlets whimsical and elaborate wood-carving attracts tourist dollars. Excellent technical schools, turning out finished craftsmen, and intelligent development of water-power to furnish electricity, are the two strong arms of Swiss industry. Higher education is cared for by seven universities, of which the one at Zurich (founded in 1460) is the oldest. Lack of coal is a serious handicap, but some use is made of lignite and peat.

AN UPHILL JOB

It is an uphill job literally as well as figuratively for it has taken years to clear this field of all its rocks and small stones. Switzerland probably has a larger percentage of mountain area than any other country in Europe, but it also has fertile valleys in the very shadows of mountains capped with eternal snows, and in its northern part it is a fairly level plain.

Bern, the capital of the federal government, has little industrial importance, but is famous as the seat of various international conferences and associations. Since the adoption of the present constitution in 1848, Switzerland has had a government somewhat like that of the United States, with a supreme court, a house of representatives, senate, president, and federal council with duties corresponding largely to those of the president's Cabinet in the United States. The president, however, is elected annually by the two houses of the legislature, and his powers make him little more than chairman of the federal council. Each canton has its own legislature, executive and judiciary. Three of the older and less densely populated cantons have preserved their ancient democratic assemblies—similar to the New England town meetings—in which each citizen of the canton appears in person; usually they meet once a year, on the last Sunday in April or the first Sunday in May, and always (weather permitting) in the open air. These assemblies elect a sort of standing committee and also the chief magistrate of the canton as well as the judiciary.

The excellent federal management of Swiss railroads, postal system, and public education is everywhere famous, as is also the system of national defense. There is no standing army, but between the ages of 16 and 20 the young men are trained in gymnastics, marching, and the use of firearms for short periods each year. At 20 they have 60 to 80 days of intensive training, and each year thereafter until they are 48 they report with full equipment for military inspection, and at stated periods attend training camps of short duration. Gun clubs, making the Swiss excellent marksmen, are found in every town and village, and the whole matter of army service is looked upon as a joy rather than as a burden. Among other institutions of the Swiss, mention must be made of the "initiative and referendum," which other countries (including some states of the United States) have borrowed as a valuable and democratic legislative device (*see* Initiative and Referendum).

The Glaciers of Switzerland

LET us go to Switzerland for half an hour for a winter holiday; let us go for a short ride to the massive world above the clouds up the great stairway that leads us a mile nearer to the sun. We will imagine that we are in one of its popular centers—the Engadine valley in the southeast, which lies about the famous health resort of St. Moritz in the canton of Grisons.

Up into the Rhaetian Alps we go, our little engine panting with its trainful of happy people, up the steel way that lifts us nearer and nearer to the sun. Thrilling and beautiful it is to look through the broad windows across the ravines to the fir-clad mountain slopes, up the great heights ever white with snow, through the graceful arches of the long stone bridges rising from the valley bed, down the deep gorges with their rushing torrents a hundred feet below us.

We are riding up to the eternal snows, but here, all about us, millions of fir trees grow, and their green branches, hanging heavy with snow, with the long white daggers at the tips, are a glorious sight to see.

It is almost too good to be true, this beautiful world. Yet this is no dream, for there, right below us, is a little town; and there, right above us, is another. Over these bridges, and through these tunnels, and round these curves, and up these spiral ways we go, and we think that surely men have never made a more daring way than this.

Climbing the Alps in a Railway Train

The ships in the Panama Canal go upstairs and down again on their way from one ocean to the other, but even this is a simpler thing than lifting a train up the mountains of the Albula Pass. We go around and around, through more than 40 tunnels, over a mile and a half of bridges, and nothing could be more ingenious than the way in which the clever makers of this line carry it ever up, safe all the way. It is as if a train were to rush into a church and come out at the top of the steeple, and this miracle is seen every day in the Alps, until the wonder of it all is lost.

Out at the top, at Bergün, we ride along the side of a precipice nearly 500 feet above the valley bed; and we cross a deep ravine, bridged by 11 great arches, with such a sense of safety that nobody fears the train will fall into the river 275 feet below.

Beyond Preda we reach the Albula Tunnel itself, three and three-quarters miles long, and in the tunnel we climb to our greatest height. Out from the heart of the rock we rush into the sun, a mile above the world of men. One mile of space we have conquered between us and the sun, and a wonderful vision it is that we get of the earth.

It is not true that a railway destroys the poetry of the Alps. There is true poetry in this way of a thousand wonders, the way which, when all other roads are closed, is still open to bring the traveler to these wonderful tops of the world. It is as thrilling to think that men have made this railway, that men have searched deep down in Nature and found the natural laws that will lift a train to these great heights, as it is to climb up a mountain with a stick and a rope, risking a life which is not ours to throw away.

For three hours we have been riding, and at last we reach Bevers, and in front of us are the great white peaks. As we step into the snow we wave goodbye to our brave little train, and we think of it as a poet thought of something like it:

> It lifts me to the golden doors,
> The flashes come and go;
> All heaven bursts her starry floors
> And strews her light below.

Now our minds, filled with the wonder of these few hours, are at ease again, for outside the station the sleigh bells are ringing, our bags are set on a sort of great toboggan, and we glide along the snow, up the hills by the bob-sled runs, down again past the little churches, to a hamlet where we may live among glaciers and chamois, with an electric railway which will carry us up to them.

The Stories of the Mountains

It is good for us to live among the mountains. Something we shall not quickly lose comes into our life as we look upon a glacier, the great white river coming slowly from the mountain-tops. We must see them in the summertime to see them at their best, when the river of ice comes down through a forest ablaze with summer glory, through vineyards and cornfields and orchards, so that those who would gather the fruit must stand sometimes on a block of ice to reach it. Winter and summer are here side by side; life and death together, we see them.

But perhaps we should not call this river Death, for travelers say that in the hot sun you can almost hear it singing. This solid river of fantastic shapes, with deep crevasses and rising towers, with a surface twisted and tortured and broken, with a burden not of ships and boats but of rocks and pebbles and bowlders, goes on its resistless way, not falling softly over a precipice like water, but splintering and shivering in cracks, and coming together again in some mysterious way as if it had never been broken. These crackings in the mass, the rolling down of great bowlders, the melting of ice, the falling of pebbles into some deep crevasse, have sounds like thunder and soft music, and those who know these glaciers will tell you that they love the singing of the ice. As the trees sing in the forest, so the field of ice that runs past is filled, says one traveler, with the harmony of joyous sounds. "The little drops, falling on the projections in the crevasses, tinkle as they are broken up; the gradually forming rivulet murmurs on its way; the slopes of gravel crumble down into the crevasses; and here and there some block, uncemented from its icy pedestal, roars as it rolls down. All these voices

of the glacier gain strength as the sun gets higher in the horizon, but if a thick cloud suddenly interrupts the solar rays silence is gradually reëstablished, and the glacier waits for the return of the sun ere it resumes its song."

But in winter, too, a glacier does its work; in winter, too, with snow and ice about it everywhere, it is a majestic thing to look upon. The snow will melt where it lies, but the glacier never will melt there; it will go down into the valley and fill narrow beds with babbling brooks; it will dash over a cliff as a waterfall, or fill up a valley and form a lake, or join the Rhine and go out into the cities of Europe and on into the North Sea, and across the Atlantic Ocean —perhaps it will be carried by a current some day to the Panama Canal.

None of us will be there to see, but it will go. The flake of snow will melt. The drop of water will find a crevice in the ice, and there it will freeze again, and explode with a power like the power in a bomb filled with powder; and this melting and freezing in the glacier, happening always, everywhere, will move it from the hilltop to the plain. It may take a hundred years to reach the valley, traveling perhaps two feet a day, but time is nothing to a glacier, and in the Alps a hundred years is as an hour. *They* have the ages before them; *we* must work while it is day.

The glacier rolls along as surely as the Mississippi. This river of ice, solid to the bottom a hundred yards deep, rolls to the sea as surely as the wind sweeps over a field of wheat. The solid waves on its surface rise and fall, eddy and whirl, ripple and splash.

The Resistless Movement of the Glacier

We stand on a glacier and are borne along as certainly as in a boat on a river of water, and we understand that there are things beyond our senses, movement that we cannot see. There is no doubt of it whatever. In 60 years one glacier toppled over dozens of chalets. In 1827 a professor built a hut on a glacier to study the ice. In three years it moved 330 feet, in 9 years 2,000 feet, and in 14 years it was nearly a mile away. It once took a glacier 12 years to carry a man's hat a mile. Another took a bottle half a mile in 9 years, and 70 yards in 3 years. In 1820 three guides perished below the heights of Mont Blanc, and after 41 years the bodies arrived at the foot of the glacier 5 miles away; from a depth of 200 feet down they had reached the top, so that 200 feet of ice had melted. Now and then a shoe or a stick or a bone comes up in a glacier, the remains of some unhappy traveler long forgotten; and once, in 1860, a glacier threw up the body of a man in a costume centuries old—gave his body back to the world quite well preserved, like a mountaineer walking out of an old-fashioned costume-book!

So surely do they move, pushing before them or carrying with them rocks shattered from the mountainsides or torn up from their own rocky beds. Like a saw or a plane the glacier makes its way along its bed, not gliding over the earth, but gripping it fast, so that we can see the marks where it has passed, and a stone falling through a crevice to the bottom is dragged along, leaving a great scratch in the earth. Who knows what this giant brings with him as he comes? He brings the spoils of distant mountain slopes, the ruins of famous mountain peaks, pebbles worn as smooth as glass, bowlders weighing a thousand tons. No wonder we find a peasant sometimes afraid of him, for though he comes slowly, the giant glacier comes dreadfully at times, so big that six Chicagos or New Yorks could be made out of him. If he should come to the end of a valley and cross the bottom so as to close it up, his coming might spell doom to that valley. There is a valley in the Alps once crossed by a glacier which formed an ice barrier half a mile long, and the valley was drowned in 800 million cubic feet of water. Then the people rallied around an engineer and dug a tunnel in the ice, through which the water burst in a volume a hundred yards high, sweeping away a plantation, spreading devastation and ruin on every hand.

The Wonder of the World of Peaks

It is a wonderful thing for those who live in lowland towns to take one of the little Alpine trains and be lifted into a world of snow-white peaks and icy precipices, seeming to stretch from your window away into ever and ever. No words can tell it, no brush can paint it, no camera can copy it; he who would understand its fascination must see it.

And if, when you go, you leave the train at Alp Grüm, you will stand then a mile and a half nearer the sun than when you left France. It is called the Palü Glacier on the map, but how little a name really means! From the peaks high above us this incredible river of solid ice gathers the force that drives it down the gorge through which it slowly cuts its way. Over there, down, down, is the road that leads to Italy, and we look down to see what the road is like. But we see nothing, for below us are *the clouds!* Like a lake of water they hang in the air, and we wonder what it is like in the village where the people walk below them. From the clouds below us we look to the skies above. High up above the glacier is the blazing sun; lower down, above the falling clouds, hangs the pale white moon.

Wonderful it is to be standing in this place, to stand and see, in one place and in one moment, these pillars of the heavens and of the earth, four links in the long, long chain that binds the universe, four chapters in the story of the world!

We are looking on at the ever-new creation of the world. Above us are two huge moving things—the sun and the moon. Below us are two huge moving things—a sea of cloud and a mighty glacier. What unity can there be between the soft quick-moving sea of cloud, like down, filling the valley below us, and the solid slow-moving river of ice, like masonry creeping down the mountain slopes? Well, in the wheels of God, that run forever, they fit like four wheels of a watch. It was the sun that brought them

SPRING'S FIRST FLOWER IN WINTER'S SNOW

In Swiss poetry and legend no flower plays a more conspicuous part than the Edelweiss ("noble white"). Famous not so much for its beauty as for its rarity and the difficulty of obtaining it, it has become so scarce that some of the Swiss cantons protect it by law. Sometimes it is found on wooded hillsides, but more often it seems to retreat to almost inaccessible rocky heights, where it is in little danger from its greatest enemy, the tourist. Such scenes as this are among the great charms of Switzerland. Even in midsummer, along the upland paths, it is not unusual to come across snow, setting off the somber larches, pines, and firs, and the brighter greens of the grasses and underbrush. Then around a corner of the path the traveler comes face to face with a gigantic snow-and-rock mass like the one in this photograph. As we look long at it, it seems to tell us its secrets. We feel that we can measure it, that we know where it begins and where it ends, that we shall never forget its size or shape.

contained in the Easy Reference Fact-Index at the end of this work

here. That blazing ball in the sky sucks up the cloud from the sea, and drops it as snow, which freezes to ice and forms the great white glacier cutting its way through the rock. From the sea came the clouds, the glacier, the very Alps themselves. And the moon hanging there — what place is hers in this great scheme of things? She is waiting her time. She will shine on this great white river tonight, catching a glow of the sun and giving it back to the earth, and perhaps for a million nights to come she will shine on a glacier here, silently watching the great thing move, though seeming powerless to move it herself. Yet she waits her time, and when her time comes she will pick up this great white glacier and dash it against the cliffs, splashing it about in the sea as a child splashes a wave with its foot.

So that this very sun may draw this very cloud up to the skies, this very cloud may fall as snow and creep as a glacier down this very gorge; and this very moon, when the glacier has become a river and reached the sea again, may roll it along in the tide to the very beach on which you play. We stand in this place and watch it all. The wheels of the universe are going around before our eyes, yet how still it is! Slowly, silently, surely, the mills of God go round, and they grind exceeding small.

WHERE ENGINEERS HAVE CONQUERED THE ALPS

Up the narrow Engadine Valley, first on one side and then on the other, in one mountain side and out through another, turning to every point on the compass, runs the Albula Railroad, the most wonderful narrow-gauge road in the world. This photograph shows the stone viaduct over the Landwasser, a tributary of the Upper Rhine. Emerging at the right from a tunnel, the train dashes across the curving bridge, 213 feet above the torrent. In the mountain at the left are two loop tunnels, whose position has been indicated so that you can get a better idea of some of the complicated problems faced by the construction engineers.

Meditation in the Silences

The silence of an Alpine height can never be destroyed. Here comes no thunder from the world below; the mountain peak is like a throne of meditation for the human race. And well it is that men should meditate in these great silences. How came they here—these giants that have raised their heads to the sky since the first man was born? The answer to that is a tale no story-book can rival. These mountains, holding their heads proudly to the sun, once stood at the bottom of the sea. These dazzling peaks, keeping company up there with the eagles, once bowed down their heads among sharks and whales. And the day will come when these virgin towers of heaven, tired of the eagle and the sun, will go down into the sea again, and rest from age to age in the dark cold waters.

Even now they are on their way. The Alps are tumbling down; the rivers trickling down their sides carry them away. As surely as the bricks are being removed from some old building that has fallen down, so surely the bricks of the Alps, the heights and depths of this great mountain range that shelters Italy from the outer world and gives a home to the brave Swiss people, are being removed by visible forces, carried on the backs of raindrops.

We look down on the great Walls of Silence that keep back the noise of Europe, where not an echo of war comes, nor the whirring of the wheels of peace. Yet what men call the Evolution of the World is at its height about us. These Alps, that look so still, move every hour—move not merely with the movement of the earth in space, but move of themselves where they stand, crumbling into dust, marching to the sea.

Three great processions to the sea we witness from any Alpine height. The snow is melting, and the water is trickling down wherever it can find a bed; it is going to the sea. The solid white river of ice is

moving as fast as it can go; it is moving to the sea. The great granite peaks are wearing away, and their dust is carried down; it is carried to the sea. From the sea they came, to the sea they go, and forever the procession moves on. Deep calleth unto peak, peak calleth unto deep. Perhaps in a hundred million years the answer to the call may come; and as for us, we stand here for an hour, and think it wonderful.

We come down from our great heights to the happy life of the valley again, with its endless round of healthy play, the skiing down the mountain-sides, the tobogganing down the runs, the sleighing over the snow, the skating and curling on the ice. Nowhere else in the world, perhaps, can we come back from such great scenes of the majesty of Nature to find change in such incessant jollity. Not only a marvelous world is it that we live in; it is happy and gay. If we are interested enough to watch it, there is the simple life of the Alpine hamlet. The women bring their washing to the fountain in the street, and sing and chatter as they wash. The cows, driven from their pastures by the snow, spending the winter in the dark sheds under the houses, take their peep of daylight in the afternoons, on their way to the fountain.

The sturdy village men with their brooms seem to be ever sweeping the roads and runs, or keeping clear the pathways through the woods. The pleasant sleigh-bells are always jingling in the street. The little shops are full of quaint and pretty things, especially the shops of the peasants, who will cut a piece of the fine close-grained timber growing here, and carve it at their own doorway into a wonderfully vivid eagle or a chamois. Up the mountain slopes sometimes we may stand and watch the chamois come down slowly to a pool to drink, look up startled if the slightest sound should reach their ears, and then bound back again; and the sight of these graceful creatures of the snows, moving slowly toward the peaks until they are tiny specks to the human eye, is something from which it is hard to turn away, so fascinating is this procession in the virgin snows, up to where the eye can see no sign of life, along a path that seems to lead to nowhere but the boundless sky.

And yet up there, though the chamois cannot know, may be a graveyard of creatures that once lived in the sea, and died in the sea; for even at two miles high sea fossils have been found, and we know that these heights were forced up from the ocean by enormous pressure of the rocks, much as the parts of a paper ball are forced up if we press it at the sides. Ages ago fish swam through the deep waters that covered those rocks; ocean waves swept high above the loftiest of those peaks. Yet today, where the fishes swam in darkness, the chamois leap and bound in the glad light of the eternal sun.

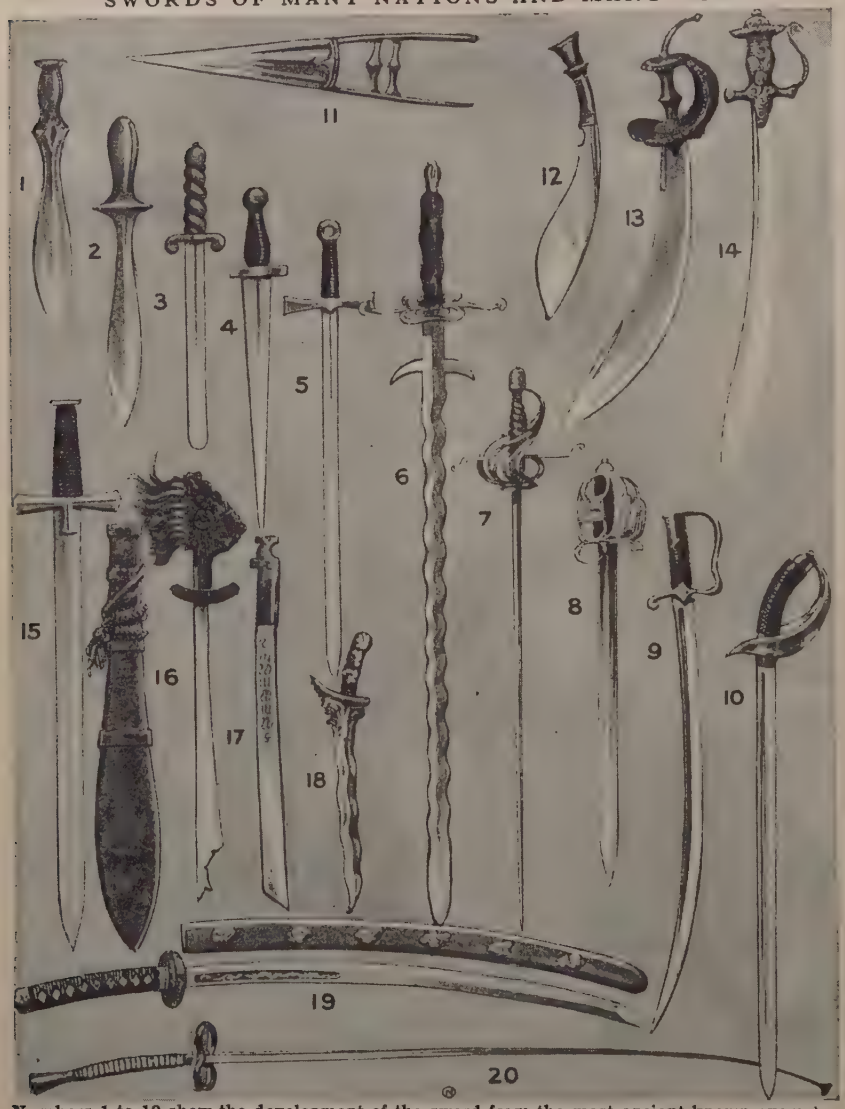
In Switzerland, we feel as we gaze on these Alps the mightiest constructive work of Nature in the past. How small a man feels as he stands with a hundred miles of mountain peaks before him, feeling the stillness of these summits, the triumphs of Nature's architecture, raised without hands thousands of centuries before man built his cathedrals and towers! It is humility that Switzerland should teach us, for here we see the grandeur of our Mother Nature, and in her presence we feel like children.

ON THE WAY TO MONT BLANC

Three mountain climbers have halted for a midday bite in the shadow of a jagged *serac* (this is the name given to the ice turrets which arise as the glacier cracks and breaks in its descent). You might think that it is cold on the glacier, but really it is hot work to climb, as the uprolled shirt sleeves of one man testify. Notice that all of the men are wearing dark glasses to protect their eyes from the glare of the snow. Snow-blindness comes most unexpectedly, and is always dangerous.

SWORD. That "most romantic of weapons," the sword, has been the symbol of war, the badge of honor and courage among fighting men, since the days when bronze and iron were first hammered into blades. The right to carry a sword has almost always been a mark of rank; and today, when most of its usefulness has departed, it remains part of the dress uniform of army and navy officers the world over.

SWORDS OF MANY NATIONS AND MANY AGES



Numbers 1 to 10 show the development of the sword from the most ancient known examples to the World War; numbers 11 to 20 are modern weapons of various nations. 1. Sword of the Bronze Age. 2. Greek. 3. Roman. 4. Norman (about 1066). 5. Crusader's. 6. Two-handed, 15th century. 7. Rapier, 16th century. 8. Basket-hilted Ferrara, 17th century. 9. French cavalry, about 1800. 10. English cavalry, 1914. 11. Dagger from Mahratta. 12. Gurka "kukri." 13. Indian "talwar." 14. Indo-Persian scimitar. 15. Soudanese sword and scabbard. 16. Sword from Timor (in the Malay Archipelago). 17. Central American "machete." 18. Malay "kris." 19. Japanese sword and scabbard. 20. Fencing foil.

In the days of chivalry knighthood was conferred by the flat of the sword laid on the young warrior's shoulder; in many lands kissing the ruler's sword was a token of homage; oaths taken by a soldier on his sword were rigidly binding; when a general surrendered his sword, he admitted complete defeat; and to have his sword broken by his superior officer was the worst degradation that could come to the disloyal or cowardly soldier. These and many other sword ceremonies reappear constantly in history, while all mythologies and folklore contain tales of magic swords, like King Arthur's "Excalibur."

In modern warfare, the work of the sword, and of its smaller brother, the dagger, and of its cousin, the spear or lance, is mostly done by the bayonet fastened to the rifle muzzle, or carried in a scabbard at the belt. But for many centuries before the invention of firearms, the sword in one or another of its many forms was the principal weapon of the fighting man.

The sword's ancestor was probably the stone dagger of the cave man. Among the earliest historical blades are the leaf-shaped arm of the Greeks and the long thin Assyrian sword. As nations progressed in the military arts, they usually shifted from the chopping swords to the sharp-pointed thrusting weapons. Thus the short sword of the Roman legionary defeated the heavy blunt-ended sword of the northern barbarians, and it was literally "at the point of the sword" that the Mohammedans, who carried curving scimitars and yataghans which could only be used for slashing, were kept out of Europe.

The heavy two-handed sword of the Middle Ages was abandoned as soon as the invention of firearms destroyed the usefulness of shields and armor. In its place grew up the saber, the rapier, and the smallsword, and with these lighter blades swordsmanship became a fine art. During the 17th and 18th centuries in Europe, it became the custom for all men, even civilians, to carry swords, and quarrels were usually settled on the spot with cold steel. In the reign of Louis XIII in France

dueling became such a rage that fencing masters were everywhere in great demand and highly honored. Earlier duels were fought with sword in one hand and dagger in the other for parrying. Later a cloak took the place of the dagger, and finally with the adoption of the slender, needle-pointed rapier even this protection was abandoned.

The saber, either straight or curved, was always the special weapon of the cavalryman, and it survives today in some armies. The short cutlass was the arm of the sailor.

Various races and peoples have had special swords and daggers associated with their names throughout history. Thus we hear of the curved tulwar of the Persians, the sickle-shaped kukri of the Indian Gurkhas, the delicate katana of the Japanese, the Malay kris with its wriggling blade, the heavy-pointed machete of tropical America, the deadly bolo of the Filipinos, the bowie knife of early frontier days, and scores of other members of the sword family.

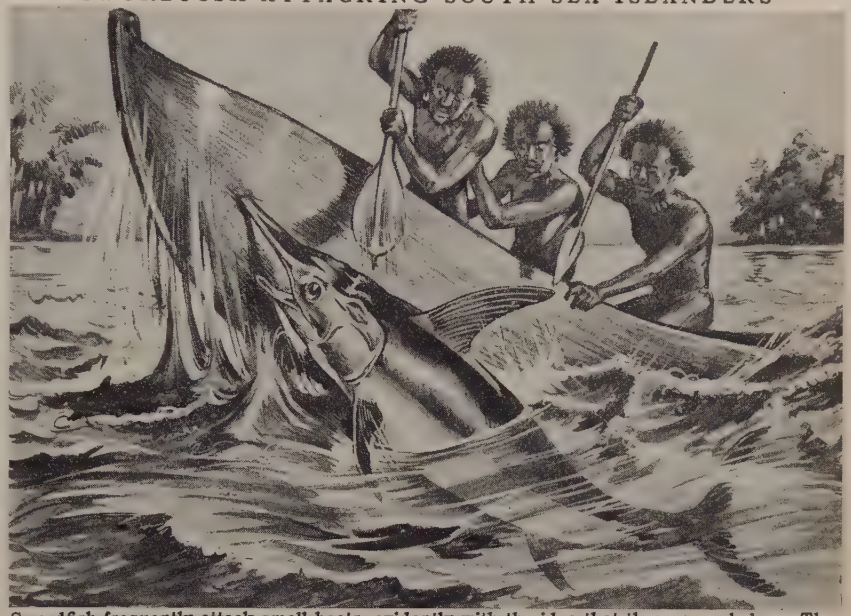
Sword-making used to be one of the most honorable trades. The cities of Damascus and of Toledo in Spain formerly owed much of their reputation to the skill of their swordsmiths.

Swordfish. The champion duelist and bullying swashbuckler of the open seas is the huge and swift swordfish, whose weapon is always ready for attack or defense, since it is fastened to the end of his nose. Like all insolent soldiers of fortune, this bold fish is careless of his company, and may be found in almost all deep seas from the Mediterranean to the California waters.

The swordfish is shaped like a mackerel, but he grows from four to 15 feet long, weighs from 150 to 800 pounds, and fears nothing that swims or floats. His "sword" is sometimes three feet long and is formed by the prolonged and toughened bone of the upper jaw, which is somewhat flattened and has an exceedingly sharp point. Swordfish swoop upon a school of menhaden, herring, or mackerel, stabbing and cutting up in a few minutes an incredible number of these fish, which they then proceed to eat. But they gladly turn from their prey to attack a whale or a giant squid, toward which they seem to feel an unreasoning ferocity. In these combats they are usually victorious.

Swordfish frequently assail boats and ships, evidently mistaking them for whales. They easily pierce the light canoes of the natives of the Pacific islands, and even the heavier boats of the professional swordfish hunters, often dangerously wounding persons sitting in them. Attacks by these monsters even on larger ocean-going vessels have been so common in the past as to be recognized in law as among the "perils of the sea." A noted English jurist once described in court the power of their attack as "equal to the accumulated force of fifteen double-handed hammers." They shoot themselves through the water at such speed that they have been known to drive their long sharp weapons clear through the copper-sheathing, oak planks, and timbers of a ship, to a depth of ten inches.

SWORDFISH ATTACKING SOUTH SEA ISLANDERS



Swordfish frequently attack small boats, evidently with the idea that these are whales. They shoot themselves through the water with such speed that they have been known to drive their sharp snout through ten inches of timbers, and they easily pierce the canoes of the Pacific Islanders. Frequently the fishermen are wounded or killed in the struggle.

In the British Museum in London is preserved a section of ship-planking a foot square which encloses the broken ends of three swords of these fish, driven in during a joint attack on a sailing vessel.

There is a species of swordfish called sail-fish, from the fact that it has a long high back fin, which it often raises above the surface, according to some authorities, allowing the wind to propel it forward along the surface.

Swordfish are much sought as food. They are usually harpooned from small boats, and their capture, as has been indicated, is surrounded with much danger and excitement. Off the New England coast from 3,000 to 6,000 of these fish are taken every year. The sawfish, which resembles the swordfish somewhat in appearance and habits, belongs to a different family, being related to the sharks and rays. Scientific name of common swordfish, *Xiphias gladius;* of sail-fish, *Istiophorus nigricans.*

Sycamore. One of the largest and most luxuriant of forest trees is the sycamore, or buttonwood, names by which the species of plane-tree native to the United States is commonly called. It is found along the banks of streams and in rich bottomlands throughout the country, but is most abundant and attains its largest size in the valleys of the lower Ohio and Mississippi rivers.

THE SYCAMORE WITH LEAVES AND "BUTTONS"

The Plane-Trees, of which the Sycamore is the American species, get their name from the Latin word which means flat or broad. The Sycamore thrives best in the rich alluvial soil of the river valleys in the Central Western states, where it often attains a height of 100 to 150 feet, and a diameter of 10 to 15 feet.

The sycamore is a rugged handsome tree, from 70 to 120 feet high, with occasional giants 150 feet high. It is often divided near the ground into several secondary trunks, with spreading limbs at the top which form an irregular open head. The old bark flakes off in irregular brownish sheets, exposing the smooth greenish-white new bark in mottled patches beneath. In winter especially the ghostly white of the trunk and limbs gives the tree a weird and striking aspect. The flaking off of the bark is explained by the fact that the bark tissue is rigid and incapable of expanding with the tree's growth, as does the bark of other trees. The broad leaves of the sycamore are bright yellow-green above and paler below, and the fruit is a decorative round button-like ball of fluff which swings in the wind on its long stem through the greater part of the winter. The beautifully grained reddish-brown wood is used for the interior trimmings of houses, for furniture and desk trimmings, and for cigar boxes.

The oriental plane-tree, sometimes planted in parks, is a native of Greece and western Asia. It was a favorite shade tree of the ancient Greeks and Romans and was introduced by the latter into south-western Europe.

Scientific name, *Platanus occidentalis*. Bark reddish brown on lower part of tree, smooth and light gray above. Wood heavy, weak, difficult to split. Leaves alternate, 4 to 9 inches long, 3- to 5-lobed; petioles long, abruptly enlarged at base and inclosing the buds; fruit, brown ball an inch in diameter.

Sydney, Australia. It is a holiday, and Sydney, the first city of Australia in age, size, and importance, has gone by motor, street-car, train, and boat to the shore, the woods, or the zoölogical or botanical gardens for a picnic, the universal recreation of Australia, where the day laborer is king and you cannot get your hair cut on Saturday afternoon because the barbers are playing cricket.

Easy-going Sydney lives a full life in which sports and pleasure loom large, perhaps because of the mild climate of New South Wales, of which it is the capital. At countless beaches and in magnificent parks that know no "keep off the grass" signs, Sydney is "taking an airing," sailing a boat, fishing, riding the surf, playing games, eating, studying, gossiping, reading, sewing, writing letters, or just "plain resting." On a "metropolitan cup day" at the race course, which is as much a part of every large Australian community's equipment as a cemetery, the streets are crowded, and hotels are packed.

Captain Cook, landing at Botany Bay only 150 years ago, could hardly have foreseen that he was "staking out" a continent for Great Britain or that Sydney would so soon be the seventh city of the British Empire, as large as St. Louis and a center for learned and educational institutions. It is an up-hill and down-dale city of magnificent proportions, parks on every hand, no slums, and many imposing buildings in a soft buff-colored sandstone which together with the narrow streets give a pleasing impression of age. The buildings of the University of Sydney are perhaps the most noteworthy group.

Sydney's harbor, with "deep water fingers stretching miles inland between wooded banks," is one of the deepest, safest, and most beautiful in the world, edged by 23 miles of docks and wharves where cargo boats and ocean liners from every quarter of the globe are being loaded with flour, wheat, frozen meat, wool, hides, coal, gold, silver, copper, lead, and tin in enormous quantities, and manufactured articles whose production and cheapness is made possible by the fact that the city itself is in the center of a coal basin. The total volume of shipping approaches that of Duluth or New York City. Population (including suburbs), 930,000.

For any subject not found in its alphabetical place see information

Syracuse, N. Y. Automobile gears, differentials, and transmissions, candles, china, agricultural implements, shoes, typewriters, soda-ash, tool steel, the Iroquois Indians, the Ice Age—all these should make you think of Syracuse, which presents as many varied points of interest as any city of its size in the United States. Like most of the cities along the old Erie Canal route, Syracuse is a city of varied industries. It is not only a leader in the products mentioned above, but it has a large output of automobile accessories, furniture, cement, powdered milk, and mincemeat.

The salt springs at this site were known to the Indians and were worked by early settlers. Although Syracuse was once "the salt cellar of the nation," this industry has now become comparatively unimportant. But since the region abounds in limestone as well as salt springs, the Solvay process of making soda-ash from salt has created important works in surrounding villages, where ammonia, coke, carbolic acid, and other coal-tar products are manufactured.

Syracuse takes pride in its civic efficiency and betterment work, and calls itself "the city of contented workmen." It is the seat of Syracuse University, a coëducational institution with more than 6,000 students.

The city is situated near Onondaga Lake, at the foot of the Onondaga valley. The Onondaga Indians were the "keepers of the council fire" in the Long House of the dread Six Nations, and the remnants of the tribe live on a reservation with a council house a few miles from Syracuse. The New York Barge Canal passes through Syracuse along a route known to readers of Cooper as "the Pathfinder's Trail." An even more ancient route is that through which the Lackawanna Railroad runs southward out of Syracuse—the channel of a prehistoric glacier, fed in the closing days of the Ice Age by waters from the melting ice sheet. The surrounding country offers many fine examples of glacial action. Population, about 175,000.

A STREET IN ALEPPO

This is a typical scene in a Syrian city. Notice the flying buttresses which prop up the walls, the grilled windows, even on the second story, and the brick-and-mortar dove-cotes on top of the houses. You can readily see why there is little wheeled traffic in such narrow streets.

Syria. A narrow strip of habitable land, with a total area of about 114,000 square miles, Syria extends along the western edge of the Arabian peninsula, as far north as the Taurus Mountains, with the Mediterranean on one side and the desert on the other. Syria forms a bridge between Africa and Asia, between two ancient homes of civilization, the valleys of the Nile and the Euphrates. So, too, it is a link between East and West, a great highway of civilization, a battle-ground between empires.

Look at Syria in another way and you see it as the western wing of the semi-circle of fertile land which fringes the Arabian desert, extending from the southeast corner of the Mediterranean to the Persian Gulf—the region which has come to be known as the Fertile Crescent. There are many dry places even in Syria, but to the Canaanites and other tribes that drifted into it from the desert it was a garden land. Within it are contained the rich valleys of the Lebanon Mountain region, where the Phoenicians made their home; the verdant Plain of Esdraelon in Palestine, the land of the Israelites; and the fertile Plain of Sharon to the southeast, which was the country of the ancient Philistines. Northern Syria was the abode of the Arameans, who were in very ancient times the merchants and traders of the Eastern world. Their widespread trade connections carried their language, the Aramaic, far and wide until it became the common business tongue of the entire Fertile Crescent. In time it even displaced its sister tongue, the Hebrew of Palestine, and thus became the speech of Jesus and the Jewish people of his time in Palestine.

Except for the Hittites and the Philistines, who became merged with the other peoples, these tribes which made up the population of Syria in ancient times were Semites. And although Greeks, Romans, Turks, Kurds, and European crusaders have blended with the original stock, the Syrians of today are still mainly Semitic and the language of the country is Arabic, a Semitic language which is related to the ancient Hebrew.

In spite of this racial kinship, however, these various tribes have never united to form a strong nation. This is due, doubtless, in part to their natural character, and in part to the fact that Syria is broken up

by desert and mountain into a number of petty provinces, but most of all to the fact that Syria, placed between strong rival powers, was forced to play the part of a buffer state, subject first to one great empire and then to another.

After having passed through the hands of the Assyrians, the Babylonians, the Persians, the Macedonians under Alexander the Great, and the Romans, Syria was conquered in the 7th century A.D. by the Arabs. In 1099 the Crusaders established the kingdom of Jerusalem and the principality of Antioch, but they were driven out in the latter part of the 12th century by Saladin, sultan of Egypt. In 1516 Syria was conquered by the Ottoman Turks, who remained in possession until expelled by British troops during the World War of 1914–18. At the peace conference following, although a claim for the Arabs was put forward by the king of Hejaz, the mandate for Syria, exclusive of Palestine, was given to France.

Syria is the home of many religions and sects. The Mohammedans are in the majority, although there are also great numbers of Christians and Jews. Among the many strange sects are the Mohammedan Druses, noted for their hatred of the Christian sect called the Maronites, numbering about 300,000 and under the jurisdiction of the pope, but with many special rites and privileges.

Even with the primitive agricultural methods still practiced, Syria produces considerable crops of small grains, fruit, hemp, indigo, and tobacco. The horses are splendid creatures but the cattle of the region are small and insignificant.

Among the leading cities are Beirut, an important seaport, and the seat of a large American missionary college; Aleppo, which is again becoming a great commercial center, as it was in ancient times, and which has been called "the Chicago of the Near East"; Antioch, noted as one of the chief centers of early Christianity; Jerusalem, and Damascus, the largest city and one of the most ancient cities in the world. The total population of Syria is over 3,000,000. (*See also* Palestine.)

SYRINGA (*sĭ-rĭn'gȧ*). In popular usage this name is applied to a hardy flowering shrub often seen in gardens, also known as the false syringa or mock-orange (*Philadelphus coronarius*). A native of western Asia and perhaps of some parts of southern Europe, it has become widely distributed through cultivation. It grows as a spreading bush from 2 to 10 feet high, with smooth ovated leaves and cream-colored fragrant flowers, somewhat resembling orange blossoms, and growing in clusters. The name syringa is also given to a genus of Old World shrubs of the olive family, of which the lilac is the best known.

TACOMA, WASH. Passengers on ships from Europe, from Asia, and from various cities of the Pacific coast, coming into the busy port of Tacoma, which lies near the head of navigation on Puget Sound, see before them a picturesque and progressive city built on ground which rises several hundred feet above the blue harbor and the Puyallup River. Behind a six-mile stretch of giant wharves, fringing the southern inlet of Puget Sound, lie busy criss-cross railway yards, wheat elevators, lumber mills, smelter chimneys, and hundreds of factories, together with high office buildings, parks, and wide flower-hedged streets lined with pretty homes and climbing fir-clad hills. And in the distant background, 14,408 feet above the sea, looms beautiful Mount Rainier, a great extinct volcano, here called by its Indian name, Tacoma, "the mountain that was God."

Because of excellent transportation facilities, both by sea and by land (six railroads having terminals or connections in the city), and because of the rich surrounding region, abounding in coal and in agricultural and timber lands, Tacoma is one of the busiest centers of the Pacific coast. It hums with many industries, and lumber, wood and metal products, wheat, flour, coal, coke, fish, and fruit are its principal articles of commerce.

The present city was organized in 1883 by consolidating Old Tacoma, laid out in 1868, and New Tacoma, the terminus established by the Northern Pacific Railroad in 1874. The city owns its own gravity water system and light and power plants. A commission form of government was established in 1910. The climate is mild, with an average rainfall of 36 inches. Population, about 100,000.

PRESIDENT TAFT *and His* ADMINISTRATION

A Steady Series of Advances from Assistant Prosecuting Attorney to the Nation's Chief Executive—His Great Work in the Philippines—Criticism of His Policies as President and the Party Defeat that Resulted

TAFT, WILLIAM HOWARD (born 1857). Few presidents have brought to their office qualifications of a higher order than those of William Howard Taft, the 27th president of the United States. He was a man of recognized ability and sound education, and had had extensive training alike as a lawyer, a judge, and an administrator. He had a deep knowledge of the American people and of the mechanism of government. He combined with these attainments the qualities of industry, endurance, and bravery required for what Theodore Roosevelt once called "the hardest job on earth."

Taft had inherited an interest in public service. His grandfather in the years following the Revolutionary War had taken part in the affairs of Vermont, both as a legislator and as a judge. His father, Alphonso Taft, had served as a judge in Ohio, as a cabinet officer under Grant, and as United States minister to Austria and to Russia. With this family record it was natural that William Howard Taft should be ambitious for public service, hoping especially to become a justice of the Supreme Court —an ambition which he at last realized.

Taft inherited his studious habits from his father, who had learned the German language when he was more than 70 years of age. He attained distinction in his college life, being graduated in 1878 from Yale College with second honors. In 1880 he divided with another the first prize for scholarship in the Cincinnati College of Law.

Already he had taken part in the political affairs of Cincinnati while he was studying law and doing court reporting for newspapers. In 1881 he entered his first public office, when he was appointed assistant prosecuting attorney for Hamilton County, in which Cincinnati is located. The next year he resigned to become internal revenue collector for the United States, and so began a long career of steady advancement in office for more than 30 years. Nearly every office he held he resigned, to move on soon afterward to one of greater responsibility. Most of these positions were judicial posts and were appointive. Only three times in his long public career was Taft a candidate for election by the people —twice for the presidency, and once for the judgeship of the Superior Court of Ohio.

After serving two years on the supreme bench of his own state, and three years as solicitor-general of the United States, Judge Taft was appointed, in 1892, United States circuit judge. In this office he became known as a fearless administrator of the law, but he won the dislike of the labor unions because

some of his decisions were against them. Once when they had wished to tie up the railroads around Cincinnati he granted an injunction forbidding them to do so, declaring that "the starvation of a nation cannot be the lawful purpose of a combination." He went on to say that "if there is any power in the army of the United States to run those trains, the trains will be run."

WILLIAM HOWARD TAFT

Taft's greatest work was the establishment of civil government in the Philippines. When President McKinley, in 1900, asked him to become president of the Philippine Commission, Judge Taft replied:

"Why, Mr. President, that would be impossible. I am not in sympathy with your policy. I don't think we ought to take the Philippines. They are sure to entail a great deal of trouble and expense. I don't want them."

"Neither do I," replied the President, "but that isn't the question. We've got them. What I want you to do is to go there and establish civil government."

When Judge Taft was convinced that this was his duty, he accepted the position, and thus undertook one of the hardest tasks which has ever fallen to the lot of any American. The people of the islands had been misgoverned for years. They were suspicious of the motives of the United States, and afraid of its officials. Some of them were even in armed rebellion against its authority. When Taft arrived in the islands an American did not dare go about without an armed guard. He at once set about studying the situation and hunting for remedies. His hearty good nature and even-handed justice soon won the confidence of the Filipinos. Civil government was formally established on July 4, 1901, and Taft was appointed governor.

Under his administration the islands saw the beginning of good roads, good schools, and efficient government. He personally settled one of the important problems facing the United States, that of the friars' lands, by conducting at Rome the negotiations which led to their purchase from the friars, and their subsequent re-sale to the natives and others.

In 1902 President Roosevelt offered Taft a position as justice of the United States Supreme Court. It had been Taft's dream for years to be on the Supreme bench, but he felt that "a change in the Philippines would create much disappointment and lack of confidence among the people." So he declined the alluring offer.

Two years later, feeling that his work in the Philippines was done, Taft returned to the United States to become secretary of war in Roosevelt's cabinet. In this position he had under his direction the Panama Canal Zone, and in 1906 he had temporary charge of affairs in Cuba, until a new government could be established there.

In 1908 President Roosevelt let it be known that he wished Taft to be his successor. As Roosevelt was one of the most popular presidents the country has ever had, his influence had enormous weight. This, coupled with Taft's splendid record as an administrator, gave him a big majority in the election.

Owing to a combination of circumstances, and to his own ill-chosen policies, Taft's reputation suffered severely during his four years in office (1909–1913). He had been elected on a platform pledged to revision of the tariff. The majority of the people of the country were dissatisfied with the high duties, but when the Payne-Aldrich tariff was passed they found that instead of lowering it raised the rates. Although Taft disapproved of the law he signed it, believing that it was the best which could be secured at the time. Later he defended it as the best tariff law ever passed by Congress.

The hostility aroused against the President by this tariff law was increased by controversies over the administration of the coal lands of Alaska, which led many people to believe that Taft was controlled by the "big business" interests of the country. This belief blinded them to the fact that some very important measures were passed during his presidency. The one which was of greatest benefit was the establishment of the parcel-post system in 1912. The working man was also helped by the establishment of the Department of Labor as one of the divisions of the president's cabinet.

Probably the chief events of his administration were the ratification of the 16th amendment to the Constitution, providing for income taxes; and the submission to the people of the 17th amendment, for election of senators by direct vote instead of by the state legislatures. Forty-five years had passed since the last amendments had been passed, as a result of the Civil War. People had begun to think that only in time of war could changes be made, and the passage of these in peace times was an encouraging event.

Taft's administration was a time of change and of unrest in all fields, but in none so much as in politics.

Many Republicans, disgusted with the President's policies, withdrew their support from him. The most prominent of these "insurgents" was Theodore Roosevelt himself, who had been influential in securing the presidency for Taft in 1908. The conservatives, or "Stand-Patters," however, proved too strong for the insurgents, and in the party convention in 1912 they renominated Taft as president. Roosevelt and his followers then left the convention and immediately after organized a new party, the Progressive or "Bull Moose" party, with Roosevelt as its presidential candidate. As a result of this division of the Republican vote, the Democratic nominee, Woodrow Wilson, was elected.

When Taft retired from the presidency he returned to the congenial pursuit of law, accepting the position of Professor of Law in Yale University. During the war with Germany he loyally supported President Wilson's administration, and as one of the joint chairmen of the War Labor Policies Board he aided in appeasing labor unrest and increasing the production of the country.

But his greatest work as ex-president was done in support of the League of Nations. In his official capacity as president of the League to Enforce Peace, and in his private capacity as author of numerous papers and addresses, he tried to impress on the minds of the American people that a League of Nations was the best insurance against future wars. No ex-president save John Quincy Adams has ever performed more signal services to his country, and none has won greater respect and admiration.

Ex-President Taft realized what he always said was his highest ambition when the Senate on June 30, 1921, confirmed his appointment by President Harding as Chief Justice of the Supreme Court.

TAFT'S ADMINISTRATION
1909-1913

American Occupation of Cuba ended (1909).
Dispute with Venezuela arbitrated (1909).
Payne-Aldrich Tariff passed (1910).
Rules of House of Representatives reformed (1910).
Postal Savings Bank created (1910); **Parcel Post** (1912).
Publication of Campaign Expenses in Federal Elections required (1910).
Democratic Majority elected to the House (1910).
Standard Oil Company and Tobacco Trust dissolved by Supreme Court (1911).
Canadian Reciprocity Treaty (not ratified by Canada).
Bills for Tariff Reductions vetoed (1911).
Panama Canal Tolls Bill passed (1912).
Territorial Government set up in Alaska (1912).
New Mexico and Arizona admitted (1912).
Arbitration Treaties with France and Great Britain (1912).
16th Amendment adopted, giving Congress Power to levy Income Taxes (1913).
Department of Labor created (1913); **Children's Bureau** (1912).
Non-intervention in Mexican Revolutions (1910–1913).
Taft renominated; Progressives nominate Roosevelt; Wilson elected (1912).

TAILOR-BIRD. Without needle, thimble, or even hands, this little bird of Asia is an expert seamstress. She uses her bill as a needle, with thread if she can find it, if not, with bits of fiber or grass; and she sews leaf-edges together into a wonderful sack. This she fills with wool, fibers, and hair to make a soft nest for her young. Tailor-birds are singers. They are small, with olive-green plumage above, and yellowish white beneath; the head is marked with a touch of chestnut. They are natives of India, Ceylon, southern China, and the Philippines. Scientific name, *Orthotomus sutorius.*

TAJ MAHAL (*tăzh mă-häl'*). The Taj Mahal, one of the most beautiful buildings in the world, was built by the Mogul emperor Shah Jehan at Agra, near Delhi, India, as a tomb for his favorite wife. When the Moguls came to India in the early 16th century they brought their Persian civilization with them. Persian was the court language, while the arts, especially gardening, were truly Persian. Thus it is natural to find the Hindu architects and artisans building in the Persian style for their conquerors. For its erection a vast army of Hindu workmen labored constantly for 22 years, and the Taj, with its neighboring palace and mosque, is reckoned to have cost between $20,000,000 and $50,000,000.

A beautiful story, preserved in the pages of a Persian manuscript, tells how the plans for the Taj Mahal were drawn from a dream which the empress had, and which she described to her husband. He sought throughout all India for an architect who could draw plans from her description, but in vain. Then one day an old religious man appeared before the emperor and said, "I can help you to obtain what you seek." To one of the architects he offered a mysterious drug, saying, "Drink!" And lo! before dazed eyes the wondrous monument was revealed in all its glory. Feverishly he worked, under the spell of the magic drug, until the plan was finished to its last detail. Then he fell back exhausted.

Whether this story be true or not, the Taj Mahal is a monument of wondrous beauty. It is of white marble, 130 feet long and wide, and nearly 200 feet high to the top of the huge dome, which grandly lifts itself from the eight-sided building. This is flanked on each side by two slender minarets, the whole fabric standing on a platform of red sandstone overlooking the river Jumna. It is surrounded by Persian gardens, such as the Mogul emperors laid

out in their summer capital in Kashmir. One of the most interesting sights in India, next to viewing the snow-clad Himalayas on a clear day, is to see the Taj Mahal under the brilliant Indian moonlight, when it resembles a fairy citadel.

Inside, under the great echoing dome, are the cenotaphs or false tombs of Shah Jehan and his empress. The sunlight filters into this chamber, through marble screens intricately wrought and as delicate as lace, lighting up the jeweled cenotaphs. Everywhere the walls of the interior are covered with the floral designs loved of the Persians, picked out in onyx, jasper, carnelian, and other semi-precious stones cunningly let into the white marble walls. Inscriptions from the Koran, the sacred book of the Mohammedans, are ornately carved in Arabic characters. The real tombs of the royal pair are side by side in the vaulted chamber below, and devoid of ornament.

Talc (*tălk*). The principal substance in that soft creamy powder that feels so cooling and soothing after an afternoon at the "old swimming-hole," or after a close shave, is talc. It is one of the softest mineral substances known, the hardness of other minerals being determined by comparison with it.

Talc is magnesium silicate containing a little water. It breaks up easily into thin transparent flakes which are gray, silvery, or greenish-white with a pearly luster. It hardens a little on exposure to the air, is not harmed by high degrees of heat, and holds heat well.

The finest quality, used in talcum powders, electric insulators, and gas tips, is imported largely from England, Italy, and Bavaria. Under several names —steatite, soapstone, potstone, and French chalk— the low and middle grade qualities are quarried in large quantities in New York, Vermont, New Hampshire, Massachusetts, Maryland, Virginia, North Carolina, and California, and ground in mills.

In solid masses, talc is easily carved, for even a fingernail will make a line on its soft greasy-feeling surface. Some of the beautiful blue and green glazed scarabs and amulets of the Egyptians are made of soapstone. The Assyrians made seals and signets of it; the Chinese, ornamental carvings. Primitive peoples hollow cooking vessels from blocks of it.

America produces nearly three-fifths of the world's supply and uses even a greater proportion of the talc or soapstone of commerce. You are familiar with this mineral in the tailor's fine chalk, in slate-pencils, certain foot-warmers, disks for fireless cookers, laundry tubs, sinks, and in the laboratory tables, hoods, and sinks.

Talleyrand-Périgord, Prince Charles Maurice de (1754–1838). To retain the position of foreign minister of France under the three widely different governments—the Directory, the Napoleonic Empire, and the restored Bourbon monarchs—called for tact and diplomacy of an amazing kind. Charles Maurice de Talleyrand-Périgord possessed not only these qualities but others also which made him one of the foremost diplomats of Europe. His early training for the church gave a keen edge to a naturally brilliant intellect. His intercourse with Mirabeau had taught him the foundations of statesmanship. And a stay in England (1792–94) and America (1794–95) had widened his political vision.

Talleyrand was the eldest son of a French nobleman, but he had been disinherited on account of a lameness caused by a fall from a chest of drawers when four years old, which injured his back for life. Debarred by this defect from the army, he prepared for the church. Talleyrand was too independent to stand well with the authorities, and it was not until 1789 that his executive ability brought to him the appointment of bishop of Autun.

At this time all France was a-buzz with excitement over the approaching meeting, after 175 years' disuse, of the Estates-General, the legislative body of France. Shortly after his appointment, he was chosen by the clergy of his district as their representative in that body. There he joined the liberal clergy in working for reforms, but because he supported the Revolution in its conflict with the church (*see* French Revolution) he was excommunicated by the pope.

Talleyrand was too able a statesman to approve of the excesses committed by the radical leaders of the Revolution. To avoid danger to himself, this disinherited noble and excommunicated priest finally took refuge, first in England and later in America. When the Terror was at an end and order once more restored under the Directory, he returned to France (in 1796) and became in a short time minister for foreign affairs. He clearly saw, however, that Napoleon Bonaparte was master of the situation, and attached himself to the fortunes of that aspiring general. He aided Bonaparte in overthrowing the Directory and in establishing his own power, and in return was reappointed minister of foreign affairs. But his imperial master kept the control of relations with other nations largely in his own hands, and Talleyrand's power was not so great as his title would indicate. At length perceiving that Napoleon's ambition would eventually overreach itself, and fearing for the welfare of France, Talleyrand resigned his position and began plotting for the emperor's downfall.

When Napoleon was overthrown by the Allies, in 1814, Talleyrand urged that the Bourbons be restored; and when this was done he again became foreign minister under Louis XVIII. The most difficult task of his life was now before him—to revive the power and influence of defeated France in the Congress of Vienna. The Allies were determined to impose harsh terms on that country; but Talleyrand skillfully took advantage of quarrels among them, and by the close of the Congress, in 1815, France again occupied an important place in the family of European nations.

As soon as he had accomplished this, Talleyrand resigned his position. After the Revolution of 1830, the new king brought in by that movement, Louis

A BEAUTIFUL DREAM IN MARBLE

Whether or not the Taj Mahal was, as the legend says, planned from a dream of the empress in whose memory it was erected, it is not only the most beautiful tomb in all the world, but one of the world's most famous works of architecture. Its name means "gem of buildings," and like a precious jewel it has an exquisite setting. Stately gardens surround it and quiet pools reflect the pure beauty of its majestic dome and slender minarets.

contained in the Easy Reference Fact-Index at the end of this work

Philippe, offered him the place again as minister for foreign affairs. Talleyrand preferred, however, the position of minister to England, in which he rendered the last of his great services to his country.

Talleyrand was the embodiment of intrigue and secret diplomacy, and his career was marked by many acts of treachery to those who trusted him. But throughout ran two consistent principles—love of France and support of constitutional liberty. No Frenchman of that time did more to repair the damage wrought by reckless fanatics and senseless autocrats. During his last days he signed a paper of reconciliation with the Catholic church and regret for many of his early actions.

TAMARIND. The rare beauty of the tamarind as a tree, as well as the commercial value of its pods, leaves and timber, have led to its extensive cultivation in tropical countries. The tree reaches a height of from 70 to 80 feet, has widespreading branches clothed in light green foliage, and brilliant clusters of purplish or orange-veined flowers.

The curved brown-shelled pods, three to six inches long—also called tamarinds—are filled with an acid juicy pulp. Packed in casks they are shipped in large quantities from the East and West Indies to European countries, where the pulp is used as a laxative, and in making beverages and sherbet. Boiled in sugar or syrup they become the preserved tamarinds of commerce. In India the seeds of the pod and the leaves are used in making a red or yellow dye. The tree produces a fine hard wood which is valuable in cabinet work.

Eastern tropical Africa, from Abyssinia southward to Zambesi, is generally considered to be the native home of the tamarind. Its name, meaning in Arabic "Indian date," indicates that it was introduced into medieval commerce from India. In the United States Florida is the only state in which the tamarind is successfully cultivated.

Scientific name, *Tamarindus indica.* Leaves small, pinnate. Flowers growing in terminal racemes; 4 sepals, 3 petals, 3 curving stamens. Pod, 3 to 6 inches long, containing 3 to 10 seeds.

TAMMANY. Organized shortly after the close of the Revolutionary War as a non-political patriotic and benevolent secret society, with the care of the widows and orphans of Revolutionary soldiers as one of its special objects, the Tammany Society has become notorious as perhaps the most powerful political "machine" in the world.

It was founded in New York City in 1789 by William Mooney, an ex-soldier. Its name was taken from that of Tamanend, a chief of the Delaware tribe of Indians, and Indian symbols and ceremonies were largely used in its ritual. Its meeting place was leased to a political organization which came to be known as "Tammany Hall," and which has become practically identified with the society itself. In 1800 Tammany first took an active part in a political campaign, being instrumental in carrying New York for Jefferson; and from that time, working within the Democratic party, it has exerted a powerful influence on the political history of New York City and state, and even of the United States. When in 1871 the corruption and frauds of its "boss," William M. Tweed, and his notorious ring were exposed, its reputation suffered severely. However, in spite of opposition within and without the Democratic party, it still wields great power through its strong organization and through the charities, entertainments, and other means by which it appeals to the people.

TANAGER. The bird world has nothing more brilliant than the dazzling red-black-and-yellow plumage of the male tanager; and no greater sex contrast than that furnished by the plumage of the female, who in

It took a good deal of patience and skill to get a snap-shot at this mother Tanager feeding her young, for these birds are very shy. Mother is here giving one of the babies either a nice fat caterpillar or a berry, for those are the principal items on the Tanager menu.

dull olive-green is quite inconspicuous among the foliage that forms a background for her handsome and idle mate.

The tanagers are an American family, found most abundantly in South America. The different species do not vary greatly in size, being about six or seven inches long; nor in habit, for they all feed on insects and fruits, build a saucer-shaped nest on a horizontal tree branch, and lay from three to five eggs. The song is really not much more than a very musical call. The species which are found in temperate regions during summer migrate south for winter.

Four species are found in the United States; of these the scarlet tanager is the best known. Its body is the most brilliant red imaginable, and the glossy black wings and tail make it a study in color combination. (For illustration in colors, *see* Birds.) During summer it is found throughout temperate North America east of the Rocky Mountains. The Western tanager, a somewhat larger bird, occurs from the Rocky Mountains to the Pacific coast. It is red only over the head, the body, wings, and tail being yellow mixed with black. Scientific name of scarlet tanager, *Piranga erythromelas;* Western tanager, *Piranga ludoviciana.*

TANGANYIKA (*tän-gän'yē'kä*), **LAKE.** This great lake of east-central Africa is one of the longest freshwater lakes in the world, measuring just over 400 miles; its width, however, is only 20 to 40 miles. The name signifies "the meeting place of waters." It lies south of Lakes Albert Edward and Victoria and northwest of Lake Nyasa, and is about 2,700

feet above sea-level; it is very deep, 2,000 feet in places. It was first discovered by Burton and Speke in 1858. Ujiji (or Kavele), where Stanley found Livingstone, is the principal town on the lake, and is now the terminus of a railway from Dar-es-Salaam. The western shores are chiefly part of the Belgian Congo, while the eastern are now administered by the British. The scenery in the vicinity of the lake is surprisingly varied and beautiful. Here the typical vegetation of East Africa meets and mingles with the flora of the great central forests. The slopes of the surrounding mountains are richly wooded, the principal tree being the "mvule" from which the natives make dugout canoes for navigating the lake. In the clearings along the shore stand the huts of these savages, who cultivate the rice, yams, and sugar cane, which thrive in the fertile soil. The people are mostly of the Bantu negro type.

The waters of the lake abound in animal life. The crocodile and the hippopotamus frequent the many inlets and numerous species of fish can be caught. The earliest traders in this district were Arabs from the east coast. They left little impression upon the virgin wilderness. Today, however, the Tanganyika hills resound to the throb of steamers carrying the commerce of civilization.

TANKS. One morning during the Battle of the Somme (1916), the German armies were astounded to behold an array of uncouth steel monsters emerging from the British entrenchments and crawling ponderously over No Man's Land like gigantic caterpillars. Pouring out a deadly rain of bullets, these barking war dragons were themselves impervious to gunfire. They crossed shell holes and trenches with supernatural ease, and completely ironed out the German barbed wire defenses. It was the first use of the little movable forts called "tanks," which soon became one of the mightiest of offensive weapons.

The tank is a development of the armored motor car carrying machine guns. This was of little use except on smooth and unobstructed ground, so British inventors substituted for wheels the revolving caterpillar belt of the American swamp tractor. With these as "creepers," the tank can crawl over almost any ground, no matter how choppy, and can crush down almost any obstacle. Two belts, one on each side, pass entirely around the tank. The tank is made long enough to span the ordinary trench, and the forward face is carried up from the ground at a steep angle to enable the caterpillar belts to get sufficient grip on the soil to pull out of ruts. Tanks are usually inclosed with $\frac{1}{4}$-inch steel plate or armor, and the larger ones carry several small cannon and machine guns.

These big tanks, weighing about 30 tons, are necessarily slow, so smaller tanks—nicknamed "mosquitoes" and "whippets"—only about a third as big as the battle tanks, were also built. These can travel about 12 miles an hour on level ground, fast enough to keep up with charging infantry.

The chief purpose of the tank service is to prepare the way for infantry attacks by destroying machine-gun nests and crushing the emplacements. They got their name from the circumstance that when the first of the new weapons were shipped to France they were labelled "tanks" as a secrecy precaution.

TANNHAUSER (*tän'hoi-zĕr*). According to an old German legend, Tannhäuser was a knight who, after many wanderings, came to the Venusberg (the mountain of Venus) and entered the luxurious cave-palace of Lady Venus and her court. Charmed by the wonders which he beheld, he remained and abandoned himself to sensual pleasure and revelry. At last, overcome with remorse, he went on a pilgrimage to Rome and craved forgiveness of the pope. Holding a wand in his hand, the pope told Tannhäuser that he could as little get God's forgiveness as that dry wand could become green again. In despair the knight went back to Lady Venus in the mountain. But three days afterward the pope's wand began to sprout and put forth green leaves. The pope at once sent messengers to every land to call Tannhäuser back, but in vain—he could nowhere be found. Such is the story as told in the popular ballad once sung over all Germany, and used by Wagner in his well-known opera "Tannhäuser."

There actually lived in Germany in the 13th century a knight by the name of Tannhäuser. He was a minnesinger, that is, a poet who wandered about singing love songs, as was the custom in those days. Because of his adventurous life, he came to be indentified in the imagination of the people with the knight of the legend.

TANTALUS. Do you know what the word "tantalize" means? It comes from the name of a king noted in Greek myth for the punishment he received after death. Tantalus was the son of Zeus, and for making known the counsels of his divine father, or for other reasons—the stories differ—he was stricken with a fearful thirst and had to stand up to the chin in a lake, the waters of which escaped him whenever he tried to drink. Clusters of luscious fruit hung over his head but missed his grasp whenever he reached for them; at the same time he was in terror lest a huge rock, hung over his head and ever threatening to fall, should crush him. It is from this story that we get the word "tantalize," meaning to tease or hold out hopes that cannot be realized.

TAPESTRY. The interior walls of the castles of the Middle Ages were usually unfinished surfaces of rough stone. To relieve the gloominess, they were sometimes covered with paintings directly on the walls themselves, and sometimes hung with various materials, of which the most prized were tapestries—heavy fabrics in which elaborate designs or pictures are cunningly woven. The walls of many churches and princely palaces were completely covered with wonderful tapestries hanging loosely from hooks. Beautiful pieces were hung from balconies and windows to decorate the streets on parade days, tourna-

ment fields were gay with them, and even on the battlefields they enriched the tents of the great warriors. Great personages often had several sets for their walls. The fact that Mary Queen of Scots had the best hangings removed and an older set put in place in the room in which Darnley was killed, only a few days before he was murdered, was used as circumstantial evidence against her.

The weaving of these beautiful fabrics requires so much skill that it takes 12 or 15 years to develop a first-class workman. The heavy undyed warp threads, usually of hemp, are attached to two long poles, and stretched tight until they are like the strings of a harp, except that they are much closer together—22 or 26 to an inch. Then they are wound around one of the poles until only a few inches remain open between them, and as the work proceeds the finished fabric is wound on the other.

The pattern is usually made with colored wool threads, although occasionally gold or silver threads are used to give added richness. Silk is used in China. With a *broche,* an implement something like a shuttle or bobbin, the workman weaves the colored threads over and under the warp threads so closely that the latter are completely hidden, being marked only by horizontal ribs. Since each broche carries only one color, and since several different colors are used for nearly every square inch of a complicated design or picture, you can readily see how tedious the process is.

Sometimes the pattern or cartoon which the tapestry-maker is following hangs on the wall before him. Then his loom stands upright and the finished work is known as *haute-lisse* (literally, "upright warp"). Sometimes the loom lies horizontally over the cartoon itself and the worker follows the pattern just beneath; then the tapestry is known as *basse-lisse* ("horizontal warp"). The work in both cases is done entirely on the wrong side, and in horizontal looms the weaver does not see his design from the right side till the whole is finished. The process is so slow that it sometimes takes a workman a year to do a square yard of tapestry in which there are many figures.

The art of tapestry-weaving dates from the beginning of civilization, but the oldest existing tapestries are found in the Crimea, which are believed to have been woven 400 years before the Christian era. The oldest existing mural tapestries were woven in the 11th or 12th centuries A.D. The famous Bayeux tapestry, which is preserved in the Bayeux library in France, is not a tapestry at all, but fine embroidery (*see* Embroidery).

The tapestries dating from 1483 to 1515 are generally considered the greatest achievements of the weaver's loom from the standpoint of pure art. During these years the industry was a very great one, hundreds of thousands of workmen being employed, and the greatest artists of the day supplied the cartoons or drawings. Flanders, under the dukes of Normandy, surpassed all other countries. Tournai, Brussels, and Arras were the great centers; indeed, the classical name for tapestry is "arras." You remember how Hamlet in Shakespeare's play kills Polonius by stabbing him through the arras behind which Polonius had hidden himself.

Almost every country still produces some tapestry today. Among the most important works are the celebrated Gobelin looms in France, established about 1601. Imitation tapestries are extensively produced by Jacquard machines like those used in other kinds of figured weaving. (*See* Spinning and Weaving.)

TAPIOCA. The soft little translucent balls of tapioca, which are the base of so many delicious puddings, are made from the roots of the cassava or manioc, a tropical plant of the same botanical family as the castor bean. It is grown in the West Indies and in parts of Asia and Africa and to a limited extent along the Gulf coast of the United States.

The cassava is a bushy shrub, with broad shining hand-shaped leaves. Its root development is remarkable. The roots are very thick and fleshy and filled with a milky juice, a piece three feet long often weighing as much as 30 pounds. The plant is raised from the canes or stalks of the previous season, and enormous crops are produced with little or no attention.

There are two general classes of cassava, the sweet and the bitter, and it is from the latter that the tapioca of commerce is obtained. The roots are cleaned and reduced to a pulp by cutting and grinding, and the starch particles removed by repeated washings. This starchy mass is dried on hot iron plates, the starch grains forming into the small irregular grains known as pearl tapioca. The roots of the bitter cassava contain a poison (prussic acid) which is expelled by heat. When this poisonous juice is pressed out from the plant and boiled, it becomes a delicious sauce known as cassareep.

The puddings made from tapioca are nourishing, being rich in carbohydrates (sugar and starch), are simply made, and easily digested. Tapioca is also used for thickening soup.

TAPIR (*tā′pēr*). A clumsily built animal related to the rhinoceros and the horse, the tapir forms with them a special group of odd-toed ungulates, or hoofed animals; for all other hoofed animals have an even number of toes. The tapir has three toes on the hind feet and four toes on the fore feet, but only three of the latter are used. There are several species of tapir, all having thick skins and a nose and upper lip drawn out to form an elongated snout or short movable trunk.

Tapirs are found in India, the adjacent Malayan islands, and Central and South America. The Old World tapirs are larger than those of the New World, the common Indian form being eight feet long and 39 inches high at the shoulders. The legs and the fore part of the body are black, but the sides and back are white. Those of the New World are brown or blackish when adult. The common South American form is about seven feet long, and inhabits thickly wooded districts. In the Andes it is replaced by a

THE LIFE OF DIANA TOLD IN TAPESTRY

This beautiful specimen of Beauvais tapestry, "Portière de Diane," is to be seen in one of the famous galleries of the Louvre in Paris. The design is symbolic of Diana, goddess of the hunt. With what ingenuity and skill the artist has combined the figure of the goddess herself with the various emblems of the chase! There you see the maiden-huntress, in one place with her bow, in another with her spear, and in the center preparing for the chase, while her attendants tie the sandals on her feet. In other parts of the design you see the quiver, the arrows, the hunter's net, the hunting dogs, a deer's head, the hunter's horn—and even then we haven't named them all. A beautiful piece of tapestry like this takes years of the most skilful labor.

contained in the Easy Reference Fact-Index at the end of this work

mountain variety living at altitudes of 7,000 and 8,000 feet. There are two species in Central America whose habits are little known. Tapirs commonly feed on young leaves, shoots, and fruits. Those of South America are destructive to plantations. They are hunted for their flesh and hides. Scientific name of Malay tapir, *Tapirus indicus;* common tapir of South America, *Tapirus terrestris.*

THE TAPIRS AND THEIR DRESSES

We rather expect to see human children dressed in clothes of a different pattern from their parents, but among animals such a difference in "dress" as you see in this mother Tapir and her offspring is the exception and not the rule. That short trunk you see is very useful to the Tapir, for it conveys food to the mouth, just like the elephant's proboscis.

TAR. Wood, coal, bones, and other organic substances yield the heavy oily dark-colored liquid called tar when they are subjected to intense heat in retorts closed from the air. Commercially there are two chief kinds, wood-tar and the coal-tar which is the source of so many dye-stuffs and other important products (*see* Coal-Tar Products).

Much wood-tar is produced in northern Europe, known as Archangel tar or Stockholm tar according to the source, and in southeastern United States, especially North Carolina. A cord of pine wood produces 40 gallons. Because of its large creosote content, wood-tar is largely used for preserving wood and hemp rope. It is also used in medicine, especially in cough syrups, and for antiseptic soaps.

Pitch, which has been used from the earliest times for water-proofing the seams of boats, is the black resinous substance obtained from wood-tar or the non-resinous residue from coal-tar after applying heat to drive out the volatile parts. Pitch is also obtained from petroleum, bone-tar, and stearine residues. The last two are valued by varnish and turpentine-makers. Wood-tar pitch is much used to protect timber from insects and the weather; coal-tar pitch is used in the manufacture of black varnishes, for coating iron, and for making lamp black. Persia pitch is prepared from goat and sheep dung. Burgundy pitch, produced in Finland, is a drug much used as a medicine.

TARAN'TULA. This large fierce hairy running spider is much dreaded by natives of the warm countries where it is found. Its bite is fatal to insects and small animals and is popularly supposed to be dangerous to man. People once believed that the only cure for its bite was lively music which inspired the victim to dance until he fell exhausted and bathed in perspiration. From this belief came the name "tarantella," applied to an exceedingly lively Italian dance in which the speed increases to the end.

The true tarantula is found only in southern Europe, but the name is commonly applied to many other large spiders in various parts of the world. One of these, found in the south of the United States, is much larger and more venomous than the largest of the true tarantulas.

UGH! WHAT AN UGLY SPIDER!

Spiders as a class are not popular, but the Tarantula is particularly disliked. And how quickly it can spring with those long hairy legs and seize its prey! That's why the Tarantula doesn't have to weave a web, as so many spiders do.

These spiders live under rocks and logs, or in deep burrows lined with soft silk which they spin from little silk glands located in the abdomen. They do not spin webs in which to catch their prey, but wait for it like tigers, concealed among leaves or rubbish, or hiding within their burrows. When some unwary insect passes they rush out, bite it, and then drag it into their burrows. The bite either kills the victim at once, or paralyzes it and makes it helpless. The tarantulas do not chew and swallow the substance of their prey, but suck out the blood and other body juices. Their large jaws, or man-

dibles as they are called, work up and down and not from side to side as do the jaws of most spiders.

Scientific name of true tarantula, *Lycosa tarantula*. The most common "tarantulas" of the United States belong to the genus *Eurypelma* of the family *Theraphosidae*.

TARIFF. A tariff in the political sense is merely a "list" (Arabic *ta'rifa*) of imported articles that are taxed by the customs house officials when brought into the country, with the amount of tax that each of these articles must pay. The disputes and debates are due to the great effects that the articles taxed and the rate of the taxes may have on the business and industries of the country.

For the tariff may be used for two purposes. It may be simply a "tariff for revenue only," to raise by such indirect taxes the money needed to carry on the government. Or it may be a "protective tariff," in which the rates are planned in such a way as to "protect" or build up certain industries of the country. For example, let us suppose that an English woolen manufacturer can produce and sell a certain kind of cloth for $2 a yard. If the American government puts a tariff of $1 on every yard of this cloth that is imported, the real cost of the imported cloth to its citizens will be at least $3 a yard. Hence American manufacturers who can make similar cloth to sell for $3 can meet this competition.

Arguments for Free Trade and Protection

A protective tariff in the United States was first successfully urged by Alexander Hamilton, secretary of the treasury under Washington, using the "infant industry" argument. This argues that in a new country the government should protect weak industries against the competition of well-developed foreign industries, until the new industries are able to stand on their own feet. Another reason advanced for protection is the "home market" argument. Henry Clay, for example, argued that the United States should protect manufacturers in order to build up a better home market for agricultural products. Advocates of protection have also argued for protection as a means of protecting workmen in the United States, who are usually more highly paid than in Europe, against the competition of this low-paid labor.

An argument in favor of protection that has been much relied on in Germany and other European countries is that it enables a country to be very nearly self-supporting in time of war. Relying on other nations for necessities is safe enough, say the protectionists, in time of peace; but a nation should build up its vital home industries against the day when war puts a stop to imports. Before the World War the United States depended upon Germany for many chemicals and nearly all dyes, and when the war stopped these imports, new industries had to be built up in the United States to supply these.

Most economists from Adam Smith, who has been called the "father of political economy," down to the present time have been in favor of "free trade." They say that protection is of benefit chiefly to the protected industries, and is paid for dearly by the consumers of protected goods; and that protection interferes with the natural localization of industry in different regions. If left alone things tend to be produced in the regions best fitted by Nature for that purpose. Pennsylvania specializes in the manufacture of iron; cotton and tobacco are grown in the Southern states; Montana produces wool. Cities, too, become centers almost by accident for different kinds of manufacturing, as Troy, N. Y., for collars and laundry machinery, and Detroit, Mich., for the manufacture of automobiles. The free trader argues that what works so well between different groups in the same country ought to work equally well between nations. Just as it would be poor policy for each individual to attempt to make for himself every article that he requires, so he thinks it poor policy to try to make the people of one country economically independent of people across its borders.

The British Free Trade Policy

Great Britain is the only great country which has practised free trade; and when this policy was fully adopted (in 1846), Great Britain was so far in advance of other countries in manufacturing, as a result of its Industrial Revolution, that it did not fear foreign competition. In recent years, however, there has been a revival of protectionist opinion in Great Britain. At no time has trade been absolutely free, for small duties have been placed on tea, coffee, tobacco, liquors, and the like, mainly to raise revenue.

In the United States the tariff question has largely been a sectional one. The great manufacturing region from the Atlantic to the Mississippi, and from the Ohio River to the Canadian border, has usually wanted protection for its industries, while the agricultural districts have wanted low duties on manufactures, in order that the price might be lower. The tariff question was an important cause of the Civil War, for protection aided the manufacturing North at the expense of the agricultural South. Such a situation increased the ill feeling between the sections.

On the whole the policy of the United States ever since the first tariff act of 1789 has been in favor of giving more or less protection. The Republican party has favored protection, while the Democratic party believes in a tariff for revenue only. Tariff rates steadily increased after the Civil War until the McKinley tariff of 1890. In 1894 the Democrats reduced the rates somewhat, but in the Dingley tariff of 1896 and the Payne-Aldrich tariff of 1910 the Republicans restored the rates to about the same level as the McKinley tariff.

In the 1912 election the Democratic party was successful on a platform demanding tariff reductions, and in the Underwood-Simmons tariff of 1913 the rates were lowered on many articles, and the number on the free list was greatly increased. The attempt was also made to "take the tariff out of politics" by establishing a Tariff Commission composed of impartial experts, to investigate the subject of tariff

rates and report its conclusions to the president and Congress. In 1921 after the Republicans regained power the tariff was again revised upward.

Tarpon. An hour or more of delicate and skilful manipulation and very hard labor is often required to subdue the powerful tarpon, regarded by anglers as one of the finest American game fish. When he first feels the hook in his mouth and his progress checked, he leaps high into the air again and again, shaking himself violently "with all the frenzy of a wild horse when he first feels the lasso," and a tremendous fight usually ensues before he is finally taken.

In general outline the tarpon resembles the herring, to which it is related, but it weighs up to 300 pounds and is sometimes 6 feet long. Its glittering armor of round silvery scales—as large as or larger than a silver dollar—has given it the name of the "silver king." The flesh is very good food and the scales are used in ornamental work, but the popularity of the tarpon is due principally to the sport it affords. It is found off the Atlantic coast from Virginia to Brazil and in the Gulf of Mexico. (*See* Fish.)

Tartaric acid. When grape juice ferments, a hard crust forms on the inside of the cask. This is a chemical salt named argol or acid potassium tartrate. When argol is partly purified by dissolving and recrystallizing it, it is called "tartar," and when it has been further purified and freed from coloring matter, it is known as "cream of tartar." Cream of tartar is valuable because it is used in combination with soda (sodium bicarbonate) to make many baking powders. It is also used in medicine, and is the chief commercial source of tartaric acid and its other salts. Two of the most important of these are sodium potassium tartrate, known as "Rochelle salts," and antimony potassium tartrate, also called "tartar emetic." Tartaric acid is obtained by treating the tartar or cream of tartar with sulphuric acid.

There are really three tartaric acids. The great French chemist Louis Pasteur, in 1860, was the first to discover their relationship. He observed that some of the crystals of sodium ammonium tartrate were symmetrical with respect to other crystals, but not identical with them. Your two hands are symmetrical, but not identical; they face each other like an object and its reflected image in a mirror. Pasteur put the right-hand crystals into one dish and the left-hand into another, dissolved them separately in water, and tried them in a polariscope. A polariscope has prisms which make the rays of light all go parallel, like a number of pencils bound together. If this light, with the rays all going straight and in the same direction, passes through a solution of certain substances, it is bent. If the rays are bent to the left the substance is called *laevo*-rotatory, if to the *right* the substance is called *dextro*-rotatory. With the polariscope Pasteur found one of the salts to be laevo-rotatory and the other dextro-rotatory. A mixture of equal parts of the two was inactive as regards light. Pasteur was greatly excited and rushed forth on the streets of Paris, calling out "Eureka!" which is Greek for "I have found it." Thus he solved, at least partially, a problem which had greatly vexed chemists. It was quite an important discovery, for many other compounds besides tartaric acid have substances identical with them except in this one respect—their action on polarized light. (*See* Light; Sugar.)

Tartaric acid—any of the three, for the formula is the same for all ($C_4H_6O_6$)—is made up chemically of carbon, hydrogen, and oxygen, and exists as colorless transparent crystals. Tartaric acid is found in other fruits besides grapes, although not so abundantly. It is used in calico printing, dyeing, photography, medicine, and as flavoring for beverages.

Tasmania, Australia. The "back of the beyond" was what people used to call the island of Tasmania, tucked away below the southeast corner of Australia. When the Dutch navigator Abel Tasman discovered the island in 1642, he found it a wildly beautiful spot with a rugged coast-line and high rough hills, inhabited by a strange black race. But there was little to invite settlers, and no nation attempted to colonize the island until 1803, when Great Britain sent out 400 convicts. The following year Hobart was founded.

THE "TASMANIAN DEVIL"

This strange creature, known as the "Tasmanian Devil," is peculiar to the country from which it gets its name. It is a small marsupial, or pouched animal, with so ferocious a temper that it is absolutely untamable.

For the next 50 years thousands of "undesirables" from all parts of the British Empire were shipped to Van Diemen's Land, as the island was then called. The convicts were compelled to work for the few free settlers, and many evils arose. The natives and whites clashed constantly and the "black fellows" were rapidly exterminated.

In 1853 the importation of convicts was stopped, the name of the island was changed to Tasmania, and the population was granted representative government. But at this period the discovery of gold in Australia lured away virtually all the younger people from the island. It was not until the '60's that Tasmania entered upon a period of sound prosperity.

Tasmania has a temperate and healthful climate. With lovely lakes, many rivers, abundant rainfall, and a fertile soil, the island is well adapted to agriculture. Wheat is the chief crop. On the heavily forested mountain slopes reigns the "blue gum" eucalyptus, one of the strongest, densest, and most valuable woods in the world. Great logs as big as freight cars are hauled along Tasmania's railways to the coast, bound for the farthest ends of the earth. The peaks and ridges which dot the plateau are rich

THE BEAUTIFUL CAPITAL OF TASMANIA

Hobart, the capital of Tasmania, is one of the most beautifully located cities in the world, standing on a series of low hills at the foot of Mount Wellington (the highest peak you see in the background) and fronting on a picturesque bay, opening into the estuary of the River Derwent. The streets are wide and there are numerous parks and public gardens. The harbor is easy to get at and is well sheltered and deep.

in minerals—tin, silver, lead, copper, and gold—and mining is the leading industry. The population centers about the capital, Hobart, one of the most picturesquely situated cities of the southern world.

The animal life is very like that of Australia, but the island has two strange beasts of prey found nowhere else. One of these, the Tasmanian zebra wolf, a striped creature very like an ordinary wolf in shape but having a pouch like a kangaroo for carrying its young, is very destructive to sheep. The other, the Tasmanian devil, very like a small bear in appearance, is smaller but even more fiercely bloodthirsty. It also carries its young in a pouch on its belly. (*See* Kangaroo.) Tasmania also has its peculiarities in plants, as well. Among its cone-bearing trees the island has nine species peculiar to itself, and over 250 species of flowering plants which are unknown elsewhere.

THE TASMANIAN ZEBRA WOLF

The animals all over Australasia are a queer lot. You wouldn't think of calling this creature a wolf, would you? Look at its stripes, as if it had half a mind to turn into a zebra. Like the "Tasmanian Devil" on the opposite page, the mother Wolf has a pouch for carrying her babies, showing that the animal is related to the Kangaroo.

Since 1901 Tasmania has been a state of the Australian Commonwealth. The island is heart-shaped, about 180 miles long and 175 miles wide, and has an area, including surrounding islands, of 26,215 square miles. It is separated from Australia by Bass Strait, 140 miles wide. Population, about 200,000.

TAS'SO, TORQUATO (1544–1595). The story of this great Italian poet reads like a romantic tragedy. He was born at Sorrento in that period of Italian history when the wealth and power of the country was in the hands of many princes or dukes, whose courts were centers not only of luxury but of art and learning. It was the custom at that time for poets, artists, and scholars to attach themselves to the courts of these dukes. Thus their livelihood was assured, but, on the other hand, they were not free to follow their own inclinations and were affected by any change in their patrons' fortune or favor. The father of Torquato Tasso was himself a poet and had suffered so many ups and downs in his career as a courtier that he decided his son should follow a more certain profession. Accordingly he sent the lad to the University of Padua to study law, but Torquato gave more attention to philosophy and poetry. Before he was 18 he had written 'Rinaldo', a romantic poem dealing with the stories of Charlemagne, which showed such originality that his father was forced to allow him to follow his bent and devote himself to poetry. He went to Bologna in 1563.

After a short period of study at the University of Bologna, Tasso enjoyed five happy years under the patronage of Cardinal Luigi d'Este at Ferrara, where he became a favorite of the most brilliant court in Italy. Later he entered the service of Alfonso, duke of Ferrara, and in his 31st year finished his masterpiece, 'Jerusalem Delivered', a religious epic based on the First Crusade. Instead of publishing it at once, he sent it to a group of scholars and churchmen at Rome for their opinion. They criticised the poem so severely that the sensitive Tasso was driven almost to madness. The jealous courtiers added to his sufferings by slanders and insults, and the poet became the prey of melancholy and irritability that amounted almost if not quite to insanity. One evening in the presence of the Duchess he drew his sword to stab a servant who, he fancied, was spying on him. Gossip said that this state of mind was aggravated by his love for the Princess Leonora, sister of the Duke, to whom he addressed many impassioned lyrics. At last Tasso displayed such violence of temper that the Duke sent him to a madhouse, where he was kept in confinement for seven years. During this time he wrote some of his best short poems and a series of philosophical reflections. Alfonso was finally induced to release him in 1586.

After several more unhappy years, during which the flame of genius flickered out entirely, fortune at last seemed to smile on the feeble and broken old man. He was invited to come to Rome to receive at the hands of the pope the poetic crown of laurel—the same honor which had been conferred on Petrarch in the 14th century. But the appreciation for which he had hungered all his life came too late. Before the ceremony was performed he fell ill and died in the Convent of St. Onofrio.

His chief works are: 'Rinaldo' (1562); 'Aminta' (1573); 'Jerusalem Delivered' (1574); 'Torrismondo' (1586).

TASTE. The sense of taste depends not on the muscle of the tongue, but on little projections called "taste buds" located on the tip, sides, and back of the tongue (*see* Tongue). The taste buds contain a special kind of nerve endings from which nerve fibers or conductors extend back to the brain.

When any substance in solution or any substance which is capable of dissolving in the saliva is taken into the mouth and comes in contact with the nerve endings, they are stimulated and send a message back to the brain. Then we say we taste the substance. An insoluble substance has no taste but may be felt in the mouth through the nerves of touch.

We have four kinds of true taste—sweet, bitter, salty, and sour. Each of these has its own nerve-endings, its own nerve fibers, and presumably its own center in the brain.

TATARS. "Well may they be called Tartars, for their deeds are those of fiends from Tartarus!" Such, it is said, was the appalled exclamation of the pious king, St. Louis of France, on hearing of the havoc wrought by the Mongol hordes that seethed up out of Asia in the 13th century; and such, it may be supposed, was the association of ideas that made "Tartars" out of "Ta-ta Mongols." The name of this tribe came to be applied to the whole group of tribes that formed the hordes of Genghis Khan and other Mongol invaders of later times (*see* Mongols), as well as to the kindred peoples they subdued; and the region from which they came, now loosely known as Turkestan, with the neighboring regions they overran, was called Tartary.

The name Tatar today is usually reserved for a group of tribes in Russia and Siberia, numbering about 3,000,000, mostly of Turkish origin and of the Mohammedan religion. Those in Russia are remnants of the Mongol invasion of the 13th century, though they have very slight traces of Mongolian blood or none at all.

TATTOOING. Tattooing, that queer sort of skin decoration found among many half-civilized peoples, is usually done by pricking in designs with an awl or needle dipped in different colors. Some patterns are sewed in by drawing under the skin a thread which has been dipped in color. Others are made on certain dark-skinned races by a process called cicatrization or scar-tattooing. This is done by repeatedly cutting the skin in the same place so that when it heals a raised scar is left. Many African tribes mark their boys in this fashion, rubbing wood ashes into these great gashes on the face or body, which causes swelling and healing with a purple color. In some tribes no girl is eligible for marriage until she has been elaborately tattooed. Sometimes tattooing is done as a mark of courage shown in war or to present a more terrifying aspect before the enemy. Sometimes it has a religious meaning, and again it is a sign of mourning. In Japan, where it was once a high art, elaborate color tattooing took the place of clothing. Even in civilized lands tattooing is occasionally done, chiefly among sailors.

TAXATION. Every government requires money to run it. Indeed, it is possible to think of governments as businesses that are owned by the people and engaged in doing certain things for the people that cannot be done so well by individuals. Building roads and bridges, maintaining public schools and libraries, catching and punishing criminals, and supporting the army and navy are typical examples of government activities.

Governments differ from ordinary businesses in that usually there is no payment made at the time the service is rendered. Instead, the people pay for these public services in the form of various taxes that are paid to the government.

These taxes may be direct or indirect. The best example of an indirect tax is a customs or tariff duty on goods imported into the country. The importer pays the tax to the government and adds the amount—usually with some increase—to the price he charges for his goods. Until 1909 the largest part of the income of the United States government was derived from such tariff taxes.

A direct tax is one that cannot so easily be shifted. The simplest example is the poll tax, levied in a number of states on all men from 21 to 50 years of age. The name comes from the Anglo-Saxon word "poll," meaning "head." Poll taxes have always been unpopular since the revolt of Wat Tyler against them in England in 1381. The income tax and the general property taxes levied by most American states are other examples of direct taxes.

What are the Marks of a Good Tax?

Since taxes have always been more or less unpopular, statesmen have attempted to show clearly why people should pay taxes, and on what basis the amount of tax paid should be calculated. About the time that the American colonists were fighting against "taxation without representation," Adam Smith, the famous British economist, stated the requirements of a good tax. In addition to being levied in proportion to ability to pay, he said that the tax must be certain and not arbitrary in amount, that it must be payable in the manner most convenient to the people, and that it must be inexpensive to collect. Colbert, a great French minister of finance, a century earlier had stated his idea of a good tax somewhat differently: "So pluck the goose (the people) as to produce the largest amount of feathers with the least possible amount of squawking."

A classification of taxes may be made on a basis of the way in which the amount of the tax is calculated. A general property tax is based on the value of property that the taxpayer owns. States, counties, and cities, as well as such local units as school districts and road districts, derive most of their income from property taxes. The method of operation is as follows: (1) The taxing government determines how much income it will need to perform its various services during the coming year; (2) the tax levy is next divided by the total value of all the taxable property; (3) the result is a ratio or per cent, which is called the "tax rate." The assessed value of a person's property, multiplied by the tax, gives the amount of tax that the person must pay. There are many objections to the general property tax, chiefly because its inequalities and injustices make "tax dodgers" of many people who are otherwise honest.

Income and Inheritance Taxes

A tax which meets the requirements of justice much better is the income tax. European countries have used such taxes for some time. The United States Constitution, however, provided that any "direct tax" laid by the Federal government should be apportioned among the states in proportion to the population; and the Supreme Court decided in 1894 that this provision prohibited an income tax. Not until the 16th Amendment became a part of the Constitution in 1913 was the way open for the regular use by the Federal government of an income tax. Many American states also levy income taxes. Under the income tax laws, the amount of the tax to be paid is not based on the amount of property owned; but upon the income after all necessary business expenses have been met—that is, on *net* income. In order to make the tax strictly in proportion to ability, a certain part of the income is not taxed at all, and the rate is higher for large incomes than it is for small. Thus a single man or woman by the Federal act of 1918 was allowed an exemption of $1,000, and a head of a family was allowed $2,000 and $200 additional for each child. The tax rate on incomes up to $4,000 a year was fixed at 4 per cent; on incomes over $1,000,000 a year the rate was 65 per cent. Such a tax is said to be "graduated" or "progressive." The income tax law requires every individual or partnership or corporation to file a return or report of its income and expenses on specially prepared forms. Besides the tax on net income, corporations were to pay also a tax on profits over a certain amount—the excess profits tax. A number of states also have a state income tax.

An inheritance tax is one paid by the estate of a person after death and before it is divided among the heirs, and is in proportion to the value of the property. Often the rate is progressive—that is, the rate itself increases for the larger inheritances. About three-fourths of the states have this easily collected form of tax.

Licenses and Excises

Besides the taxes mentioned, there are various taxes on special occupations and businesses, usually called "license" taxes; and taxes on certain articles, called "excises." For example there are restaurant, drug store, tobacco, and taxicab licenses. Before the sale of alcoholic beverages was prohibited in the United States a considerable portion of the Federal government's revenue was obtained from taxes upon the manufacture and sales of wines, beers, and liquors. These taxes still apply in the case of liquors and wines sold for medicinal and sacramental purposes. The United States government has for a long time collected an excise tax on tobacco; and in order to raise money for the World War a large number of articles were added to the excise list, such as candy, soda water, jewelry, sporting goods, amusement tickets, wearing apparel costing over certain amounts, and so on. These taxes are sometimes called "internal revenue" taxes. Every state in the Union now has an automobile license tax, and frequently in addition a tax based on the value and horse-power.

It is well known that land increases in value as the district grows in population. This is especially true of city real estate. The island of Manhattan was bought from the Indians for $24, but today downtown real estate in New York City is worth several times that amount per square foot. This increase in the value of land due to the growth of the community as a whole, and not to the efforts of the man who happens to own it, is called by economists an "unearned increment." Since 1911 Great Britain has planned to take one-fifth of such "unearned increment" every time the land changes hands.

Advocates of the "single tax" would go farther and would raise all the revenue needed by the government through a single tax laid on land, exclusive of its improvements. Henry George, a San Francisco journalist, gave this idea its widest circulation in a brilliant book entitled 'Progress and Poverty' (1879). His object was to abolish the extremes of wealth and poverty, and to encourage industry by exempting houses and stores, and other improvements on land, from taxation. His proposals have been criticized alike by owners of land who regard the plan as confiscatory, and by socialists who object that it does not go far enough. A modified form of the single tax has been tried in some places in the United States and Canada and in a number of German cities.

For most Americans the tax assessment blank and the tax receipt—issued by the city, township, or country treasurer—are the most familiar evidences of the payment of taxes. These are concerned with the general property taxes, which make up more than half of all the state and local revenue.

Each spring the tax assessor calls and leaves a printed blank to be filled out, setting forth the amount of household goods, merchandise, live stock, farm machinery, automobiles, stocks and bonds, money on hand or in the bank, and the like, owned by each taxpayer on the day fixed by law for the assessment. This assessment of *personal property* takes place each year. The assessment of *real estate* (land, houses, and other improvements) is usually made at longer intervals, say every five years. In some states the value given is supposed to be the full market value; in others it is one-half or two-thirds, or some other fraction of the market value. If all property in the state is assessed on the same basis, it makes little difference which plan is followed.

Any taxpayer who thinks his property is assessed too high can appear before a tax court or "board of equalization" and have the injustice remedied, in case he proves his point. The tax is usually paid in two instalments, one in the spring and the other in the fall, and a printed receipt is given the taxpayer. In case taxes are not paid when they are due, they become "delinquent" and a penalty, frequently of 10 per cent, is added. If after a certain time the tax is still unpaid, the land or other property is advertised and sold to pay the tax and costs.

WAITING FOR HIS SKIN

The reason this monkey looks so pale is not that he isn't well, but because he has just reached the papier-mâché stage of monkeys in museums and hasn't had his hide put on yet!

Taxidermy. If you go into a great museum of natural history today you will find beautiful specimens of birds, beasts, and reptiles preserved and mounted in natural positions, in the midst of cunningly constructed settings which reproduce the animal's natural surroundings. You see tiny humming-birds hovering over flower clusters; great cranes asleep amid reeds, one leg tucked close to the body; monsters of the prehistoric period stalking through ferns as tall as trees; a leopard mother asleep in the jungle with her cubs around her; great boa-constrictors coiled about tree branches, in wait for the unwary deer as it passes beneath.

Such triumphs of modern taxidermy, or the art of preserving and mounting animals, demand knowledge, skill, and artistic taste. Formerly animal specimens were merely cleaned, skinned, and stuffed; and the result was often little like the living animal. But taxidermy has now been transformed from a crude handicraft into an elaborate art. To be a taxidermist today one must be familiar with anatomy, zoölogy, sculpture, tanning, dyeing, and painting. The new school has done away entirely with the old "stuffing" idea. Now the animal to be mounted is carefully studied and compared with living specimens of the same species or with photographs. A framework of wire is covered with clay, plaster, or papier-mâché, and modeled in the desired pose as carefully as if it were a sculptor's model. Even the principal muscles are

NOT VERY TERRIFYING, IS SHE?

You wouldn't be afraid to meet a lioness like that, would you, even if she weren't stuffed and mounted on a board? This is a good example of the old-fashioned lifeless system of preparing wild animals for museums. For a contrast look at the group on the next page.

For any subject not found in its alphabetical place see information

A GROUP THAT MIGHT DECEIVE THE DEER THEMSELVES

If you came across this group of deer in the woods in winter time, wouldn't you think that they were alive? And yet they are only deer prepared and grouped by the art of the modern taxidermist, who strives to pose animals as they would appear in their natural surroundings. This group is to be seen in the great Field Museum in Chicago.

indicated. Over this dummy or "manikin," as taxidermists call it, the skin is then fitted and carefully moulded to follow the outlines. In case of the larger mammals the nostrils, mouth, and tongue are truthfully reproduced in some material easily moulded. The crude glass eyes formerly used have been replaced with hollow globes painted in startlingly close resemblance to the natural eye. The larger birds and fishes are mounted in a similar manner.

Patience and delicacy of touch are qualities needed by the successful taxidermist. One of the most difficult and wearisome processes is the removal of the skin in such manner as to disfigure it as little as possible. With sharp knives and scissors the taxidermist makes an incision at the proper place, usually along the stomach, and then patiently works the skin loose bit by bit until it comes off whole. Preservatives,

The Moa, which was sometimes 10 to 12 feet high, lived centuries ago in New Zealand. Only a skilled taxidermist could rebuild his body from fossil bones so it looks alive.

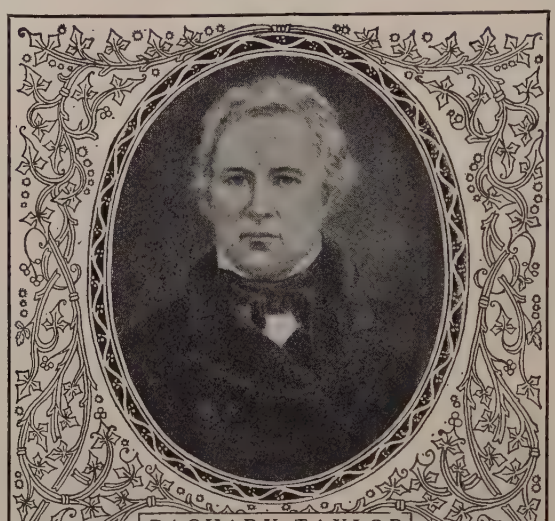
such as arsenical soap or a mixture of burnt alum and saltpeter, are then carefully worked into the skin to keep it from spoiling. Americans have excelled in this comparatively new art, and some of the most famous taxidermists in the world are found at the American Museum of Natural History in New York City and in Ward's Natural Science Institute at Rochester, N. Y.

Perhaps the highest development of the taxidermist's art is the restoration of fossil animals. This work often requires a knowledge of geology and of the evolution of animal life through the ages, as well as an intimate study of the anatomy and habits of living animals whose structure is similar to that of the extinct species. In many cases, when only a part of a skeleton has been found, the taxidermist must laboriously build up the missing parts, calling upon a vast store of technical knowledge to aid him.

contained in the Easy Reference Fact-Index at the end of this work

"Old Rough and Ready"—FIGHTER *and* PRESIDENT

TAYLOR, ZACHARY (1784–1850). General Zachary Taylor, the 12th president of the United States, was the first man to be elected to that high office with no previous political training, and he was the third to be chosen because of his military exploits. Like Andrew Jackson, Taylor was a frontiersman. Though he had been born in Virginia, the family had migrated to Kentucky before he was a year old. There he grew up with little schooling, for schools were unknown in that region when he was a boy. But around the fireside frequently gathered his father's comrades of Revolutionary days. It is probable that the conversation at such times inspired in him and his brothers the desire to be soldiers, for four out of the five boys entered the army.



ZACHARY TAYLOR

TAYLOR'S ADMINISTRATION
1849-1850

Gold Rush to California (1849).
Clayton-Bulwer Treaty with Great Britain guaranteeing neutrality of the proposed Nicaraguan Canal (1850).
Senate Debates on Clay's Compromise (1850).
Death of President Taylor (1850).

Zachary obtained in 1808 a commission as first lieutenant in a recently formed regiment of United States troops. His service in the army covered a period of 40 years, extending to the time when he was elected president. During that time he served in the War of 1812, against the Indians in the Northwest and in Florida, and in the Mexican War. On the Northwestern frontier he aided in the campaign against Black Hawk, and was the officer to whom that warrior surrendered in 1832.

In 1846 General Taylor was ordered to occupy the disputed territory between the Rio Grande and Nueces rivers in Texas. Both Mexico and the United States claimed this territory, and as soon as Taylor moved into it he was attacked by the Mexicans. As a result of this attack, Congress declared war on Mexico, on the ground that "American blood had been shed on American soil." After Taylor had won a victory over the Mexicans at Monterey, President Polk, who distrusted Taylor's views against the war, sent General Scott to Mexico as chief commander, and gave most of Taylor's troops to the new general. Santa Anna, the Mexican commander, learning of Taylor's weakened condition, immediately attacked him at Buena Vista; but after an all-day battle "Old Rough and Ready," as Taylor was called by his troops, won the day. This victory, won against such odds, fired the public imagination and made Taylor the hero of the hour. He was immediately mentioned as a possible candidate in the presidential election to be held in the next year, 1848.

But Taylor, having been a soldier all his life, had not voted, much less allied himself with either party. As a result, both parties wished to secure him for their candidate. At first Taylor discouraged all political demonstrations in his behalf, but he finally yielded and set forth in a letter his views on the important questions of the day. This letter proved acceptable to the Whig leaders. Remembering their victory in 1840, when General Harrison was their candidate, they were glad to secure another military hero as their standard bearer. His running mate was Millard Fillmore, a New York Whig, who succeeded to the presidency upon Taylor's death. Taylor had, a few years before the Mexican War, purchased a plantation in Louisiana. This plantation, which was worked by slaves, and Taylor's connection with Jefferson Davis, who was his son-in-law, won for him many Southern votes, and he was triumphantly elected over Senator Lewis Cass, the Democratic candidate.

After Taylor was inaugurated, however, he proved to be less Southern in his views than some had hoped. He advised that California form a state government and decide on her own institutions; and when that state asked to be admitted as a free state, he recommended that Congress grant the request. He also took steps to prevent secession when this move was threatened by the South. In foreign affairs his secretary of state, John M. Clayton, negotiated the Clayton-Bulwer treaty with Great Britain which paved the way for a Panama Canal constructed by the United States.

Unfortunately for the country, President Taylor died after only 16 months in the presidential chair, and while the historic debates on the Clay compromise were still under way (*see* Compromise of 1850). Many people believe that if he had lived, the slavery controversy might have been adjusted. Senator Benton said of him: "No man could have been more devoted to the Union or more opposed to slavery agitation; and his position as a Southern man and a

slaveholder, his military reputation, and his election by a majority of the people and of the states would have given him a power in the settlement of these questions which no president without these qualifications could have possessed." Taylor did not approve some features of the Compromise of 1850.

President Taylor was an honest man who as president had no political friends to reward or enemies to punish. It was because of this separation from politics that he had so great an influence, and also because he chose for his advisers men who could supplement his own lack of political experience.

WHEN *the* WORLD SITS DOWN *to* TEA

TEA. When tea drinking was first introduced from Asia into England in the 17th century, many opposed it vigorously. One man in a moment of heat denounced it as a "base unworthy Indian practice, and a filthy custom." But the use of tea, or "tay" as it was then pronounced in England and still is in Scotland and Ireland, increased steadily, and now the United Kingdom must import almost seven pounds for every man, woman, and child every year (about 295,000,000 pounds) to keep the national teapot going. The Australians and the Canadians are not far behind England as tea drinkers, and little New Zealand imports more tea per capita than even England. The United States is a nation of coffee drinkers, so their consumption of tea is only about one-seventh that of Britain. The Chinese, Japanese, and Tibetans are the greatest tea drinkers in the world, probably because of the polluted and unhealthful water supplies of those countries.

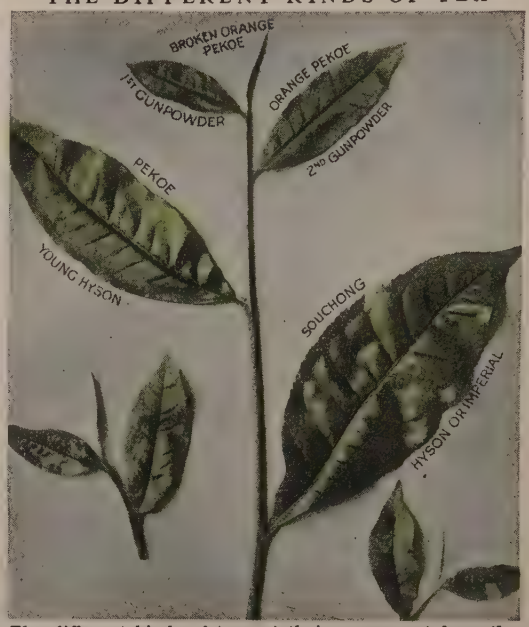
The tea of commerce is the dried and prepared leaf of several varieties of evergreen shrubs or small trees which have been cultivated in China and India for more than 2,000 years. From the beginning of the commerce in tea, China held first place as a producing and exporting country. About 1840 British India began to export tea grown on its own plantations, and because of the improved methods of cultivation and preparation the British growers are now the greatest producers in the world. Ceylon began to market tea in 1873, and the industry there now surpasses that of China. Java and Japan also have considerable exports of tea. The plant can be successfully grown in South Carolina and Texas, and there are several tea gardens in both states. Owing to the lack of cheap labor, however, it has been found impossible to produce tea in the United States in competition with the teas of Asiatic countries.

The plantations of Ceylon and India sometimes cover hundreds of acres. The low evergreen bushes have such widespread branches that the hills as far as can be seen are covered with continuous gray-green foliage. Near at hand, however, it is apparent that the plants have been set in straight orderly rows, no closer than four feet apart each way. The ground is clean and well drained, for the tea plant, like the cotton plant, is dainty and particular about its surroundings. It likes hillsides best of all for a home, although it wants plenty of water. The wild tea plants, left to themselves, often grow to the size of a small tree, but in a state of cultivation they are kept pruned to a height of three to five feet. All the leaves are thus in easy reach of the women and children, who do most of the picking. This pruning also forces the plants to produce leaves rather than wood.

When the tea is in bloom there is a profusion of scented white or pinkish blossoms. These look very much like little wild roses, with their petals encircling a cluster of yellow hairlike stamens tipped with pollen; the petals, however, are thick and waxy. The leaves are leathery and lancet shaped, with saw-tooth edges. Look at one of the open leaves left in the teapot after the tea is poured and you will see how much it resembles a roseleaf. The leaves of the Chinese tea plant when full grown are about three inches long, but those of the India variety grow from four to nine inches. The greater yield of this variety is one of the advantages of the British-Indian growers.

The plants are ready for the first picking when they are about three years old. At that time they are sending out an abundance of young leaf shoots, known as the "flush," and these constitute the first picking. As new shoots grow from the broken tips another crop is gathered. In Ceylon, Formosa, and India, where it is always summer, the flush is ready for picking every two or three weeks, but in the colder part of China and Japan there are only three pickings a year, the second being the most important.

THE DIFFERENT KINDS OF TEA

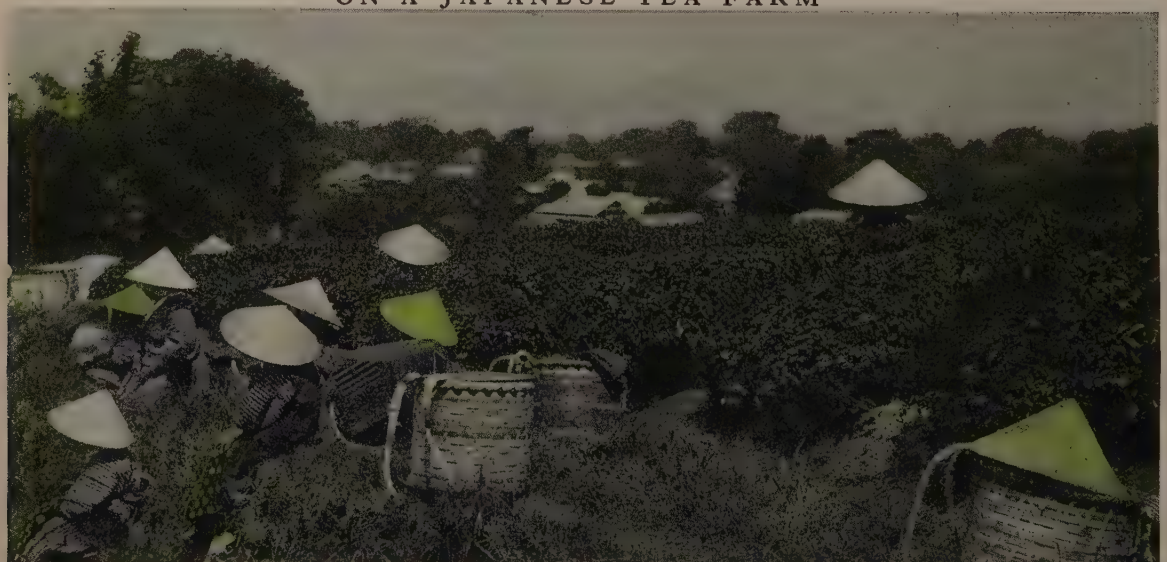


The different kinds of tea get their names not from the fact that the leaves are from different species of tea plants, but because they come from different parts of the plant. Orange Pekoe, for example, comes from the tenderest buds at the tip. The next leaf is called "First Gunpowder." The next is called "Orange Pekoe" in Ceylon, India, and Java and "Second Gunpowder" in China. And so with the names on the next two leaves.

Gathering the leaves is not easy work, by any means, for if it is unskilfully and carelessly done the finished tea will be of poor quality. The pickers have big baskets hanging around their necks. With their sharp well-trained eyes they single out from the wealth of foliage the tender young shoots, and deftly break off the top of these at just the right place and toss them into their baskets, apparently with one motion. Only the buds and the first few leaves are gathered—for the finest teas, only the buds and the first leaf. The younger and smaller the leaf, the more delicate and expensive the tea.

The flavor of tea is due to the method of curing it and perhaps to an essential oil in the leaf, but its stimulating and refreshing qualities come from the small percentage of *theine* or *caffeine* which it contains. Caffeine or closely related substances are also found in coffee, cocoa, Paraguay tea or *maté*, and the cola nut.

ON A JAPANESE TEA FARM



These pickers on a Japanese tea farm have sat down to rest. Near by are the big baskets, which are hung from their backs when the pickers are at work. Into these baskets, with a deft motion, they toss the buds and the leaves. The tea plants look like bushes because they are kept pruned to a height of from three to five feet so that even the children can reach them, and the pruning also causes the plant to produce more leaves instead of running to wood.

For any subject not found in its alphabetical place see information

STEAMING THE LEAVES FOR GREEN TEA IN JAPAN

In making green tea, as soon as the leaves have been picked they are put into a roasting pan at a temperature of about 250°. There they are tossed about by hand until the heat makes them soft and flaccid. Then they are rolled on a bamboo mat and finally dried over a charcoal fire. The manner in which the tea leaves are cured has quite as much to do with the ultimate quality of the tea as the grade of plant grown.

contained in the Easy Reference Fact-Index at the end of this work

CHINESE WORKERS FIRING THE TEA IN BASKETS

When you buy "Basket-Fired" tea of the grocer, you get a tea that has been dried in baskets like these. The tea is put into trays; these trays are set into baskets and the baskets are set into those holes which are really ovens.

SIFTING BY MACHINERY AND BY HAND

After tea has been fired, it is sorted into the various grades by sifters. The different grades are based on the size of the leaves. The smaller and therefore the tenderer the leaf, the better the tea. The picture on the left shows how this sifting is done by machinery, and on the right how it is done by hand. Tea which is much broken up is often objected to because it is supposed to be of inferior quality, but experts say the more it is broken up, the more readily it will yield its strength when steeped, with the result that the excessive steeping which makes tea bitter is unnecessary.

For any subject not found in its alphabetical place see information

PICKING OUT THE STEMS AND STICKS

In picking tea leaves, even the most expert worker gathers more or less imperfect leaves and stems. After the leaves have been through the various processes of firing and sifting, they are dumped in piles on tables like this, and sharp-eyed girls go over them carefully to remove the sticks and other bits of undesirable matter.

READY AT LAST FOR ITS LONG JOURNEY

Just before it is ready to be packed for its long journey across the sea, tea is fired again. While still warm it is packed tightly in lead-lined chests and the lead covers are completely soldered over so that it may be kept air-tight and retain its strength and aroma until it is opened at the grocery store. In this picture the lead covering has already been put on and the men are wrapping the chests in matting and fastening stout bands around them.

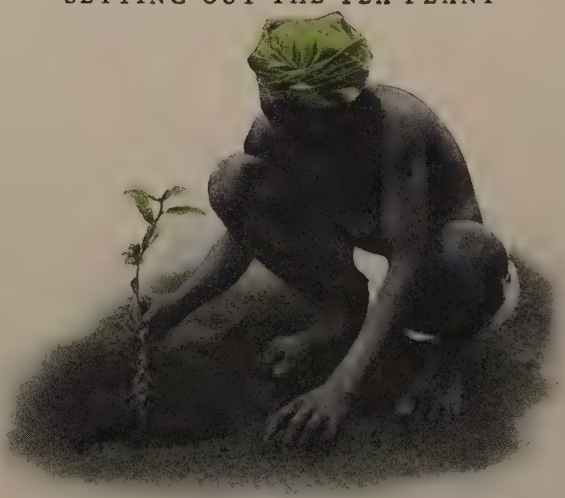
HONOR STUDENTS PICKING TEA

These are not just ordinary tea pickers. They are students from institutions of learning in Japan. They are not earning their way through college by this work as you might suppose, but were allowed to pick the tea as a special distinction, for it was the tea that was used in the coronation ceremonies of the present emperor of Japan, and only students who had earned honors by their scholarship were allowed to pick it.

Chemically it is an alkaloid, which acts as a heart and brain stimulant and is dangerous when taken in considerable quantities. A small percentage of tannin gives the tea color and adds to the flavor.

Green tea and black tea are made from the leaves of the same plant by different processes of manufacture. In making black tea the leaves are spread out on trays for 18 to 30 hours and wilted with cool draughts of air until they are as soft as velvet. This produces certain ferments which add greatly to the flavor of the tea. Then the leaves are rolled on granite tables either by hand or by machines, so as to break the leaf cells and set free the juices. Next they are spread upon tables and allowed to ferment for a few hours. When the leaves turn the color of copper, and give out the fruity fragrance of ripe apples, they are ready for firing, or drying, by hot air at a temperature of about 240° F. Then the leaves and buds are separated and sorted into the various grades—orange pekoe, souchong, etc.

SETTING OUT THE TEA PLANT



This is a native of Ceylon setting out a tea plant. The seeds, which are ripe in November, are planted in nurseries and, by the time of the monsoon rains in May and June, are six to eight inches high. They are then transferred to little pits fifteen to eighteen inches deep.

Green tea is prepared in much the same way, except that the wilting and fermenting processes are omitted and a steaming or panning process substituted, which completely destroys the ferments. In Ceylon and India most of the tea is black tea, while in China and Japan green tea represents more than half the manufacture. Oolong tea, a favorite in America, is a Japanese tea, from the island of Formosa, which has been only slightly fermented. In China and some parts of Japan, the processes of manufacture are very primitive, and the work is almost entirely done by hand. On the big plantations of India and Ceylon modern machinery is used wherever possible. In shipping tea it is packed in lead-lined boxes to protect it from the salt sea air, which spoils the flavor.

The Chinese and Japanese like best the lightly fermented teas, which produce a straw-colored drink. Their most delicate varieties are never exported. The English prefer black teas, which make a dark full-flavored drink. Americans use both varieties.

For any subject not found in its alphabetical place see information

Brick tea is used extensively in Tibet and Mongolia. This is a very cheap and coarse tea, containing twigs and large coarse leaves, steamed and pressed into bricks. Sometimes a paste made from glutinous rice is mixed with it to make the mass adhesive. In Mongolia these bricks pass as currency.

Different countries prepare tea differently. In Japan the dried leaves are reduced to a fine powder, and mixed with hot water until it is a thin pulp. Sometimes the liquid is strained but frequently the Japanese drink it, powdered leaves and all, in the same manner that the Turks and other Orientals drink coffee.

Talk about Making It Good and Strong!

Cream tea is the favorite form of tea preparation in Turkestan, in the preparation of which black tea is used, much stronger, however, than is usual. The leaves are boiled until the liquid is nearly black, cream is added and bread soaked in it, after which it is eaten.

The Persians boil the leaves in a pot until the water becomes blackish and very bitter, after which they add fennel, aniseseed, cloves, and sugar. In Chinese Tartary both liquor and leaves are swallowed.

A preparation called "shamma" is made from the spent or exhausted leaves in Baluchistan, and chewed like the betel leaf in India and the cocoa in South America, and it is said to have the same exhilarating, almost intoxicating, effect.

An infusion of tea and tansy is a favorite beverage with the people of Morocco.

In Switzerland it is customary to mix cinnamon with the leaves before making the infusion and brew both together in the same manner. The Russians seldom use milk or sugar, but always add a slice of lemon or some kind of spice.

"Yerba Maté" and Other "Teas"

There are a number of plants whose leaves are used in preparing tealike drinks. The most important of these probably is "Paraguay tea" or *yerba maté*, which is made from the leaves of a species of holly found in Brazil and Paraguay. Maté has an agreeable slightly aromatic odor, and a somewhat bitter taste. The Indians of North Carolina prepared a tea under the name of "yaupon" from the leaves of another holly-like tree or shrub. It resembled strong black tea, with an odor not unlike oolong, and it was extensively used in Revolutionary times as a substitute for China tea in the tea-tax days. A tea is also prepared in Peru and Bolivia from the dried leaves of the cacao tree. Trinidad tea is prepared from a decoction of the leaves of the pimento or allspice tree, and is in common use in Trinidad and other of the West Indies, both as a beverage and as a medicine. Coffee-leaf tea is in use in many of the coffee-growing countries, the natives often preferring it to any decoction of the berry. Every child, of course, is familiar with the "sassafras tea" prepared from the aromatic roots and bark of the sassafras bush, and with "cambric" tea, a mixture of cream, sugar, and hot water.

Scientific name of the tea of commerce, *Thea sinensis*, of the family *Ternstroemiaceae*. Chief varieties, *bohea* and *viridis*. From the variety *bohea* and its hybrids come the plants cultivated in China, and from *viridis* come the teas of India and Ceylon. Controversy has always existed as to the original home of the plant, but most botanists now believe that it is native to the whole monsoon region of eastern Asia.

TEAK. For general use in tropical countries teakwood has no equal, and for certain purposes in temperate climates as well it is preferred to all other timber. Because of its extreme durability it is largely used in shipbuilding and in the manufacture of furniture. In India and Burma instances are known where teak beams have lasted more than a thousand years. The white ant, which works such destruction on most tropical woods, while it eats the sapwood of the teak, rarely attacks the heartwood, which contains an aromatic oil. Once seasoned, this timber does not split, crack, shrink, or alter its shape, and in this respect is superior to almost every other wood. It is not very hard, is easily worked, and takes a fine polish. It has great elasticity and strength and floats when seasoned.

The teak is a native of India, Burma, the Philippines, and parts of the Malay Archipelago. Its cultivation is one of the large and growing industries of British India and Burma, where the forests are government owned and a policy of conservation is followed. The forestry department designates which trees are to be cut; they are then girdled and left standing to season for three years. Then they are cut, snaked out of the jungle by elephants, and dumped into a river. Sometime within from three to six years thereafter they reach the sawmill, that is, six to nine years after the trees have been killed.

The teak is a large deciduous tree with a tall straight trunk and spreading crown. In its youth it grows with great rapidity. Two-year-old seedlings in good soil are from five to ten feet high, and in 15 years the tree attains an average height of 60 feet. During the dry season it is leafless, and when the first monsoon rains fall the fresh foliage appears. The rough green leaves, which vary from one to three feet in length, contain red dye, and are also used in Burma for wrapping packages and for thatching. During the rainy season the teak may be recognized at a great distance by the whitish flower panicles which overtop the foliage, and during the dry season the feathery seed-bearing panicles distinguish it from other trees. Scientific name, *Tectona grandis*. The fruit is a hard bony nut, surrounded by a thick felt of matted hairs and containing small oily seeds.

TECUM'SEH (1768–1813). Of all the struggles of the Indians to hold their lands against the white men, the most dramatic was the one which had for its leader the great Shawnee chief, Tecumseh. Born on Mad Creek, near the present city of Springfield, Ohio, about the year 1768, he had from his earliest childhood seen suffering brought to his people by the whites. Year after year he beheld his people deprived of their homes and pushed farther and farther back from their

fields and hunting grounds; he saw them demoralized also by the white men's "fire-water" sold them by unscrupulous traders. He knew that the fate of the Indians was sealed unless they should join together in resisting the invaders. So he formed his plan of uniting the Indian tribes in a great confederacy. About 50 years earlier the Ottawa chief Pontiac, in alliance with the French, had formed a similar confederation against the English colonists, but the signing of the treaty of 1763 had put an end to his dreams, and Pontiac himself was slain a few years later.

Tecumseh hoped for better success through the formation of a permanent confederacy. He went from tribe to tribe, firing the Indians by his eloquence, for this untaught savage was a natural orator of great power. He was aided by his brother Tenskwatawa, "The Prophet," who was believed to possess miraculous powers. The brothers established at the junction of the Tippecanoe and Wabash rivers, in northern Indiana, a village known as "the Prophet's Town," which was to be the headquarters of the federation.

A Bargain in Land

Then in 1809 Gov. William Henry Harrison, of Indiana Territory, negotiated the Treaty of Fort Wayne by which certain Miami chiefs ceded to the United States government about 3,000,000 acres of land on both sides of the Wabash, at a price which amounted to one-third of a cent an acre. Tecumseh claimed that the chiefs had no right to barter away hunting grounds that belonged to all the Indians for a few paltry gifts or a keg or two of liquor. At a council held at Vincennes he told Governor Harrison that there could be no peace between the Indians and the whites until the land was ceded back.

Tecumseh then set out on a long mission to the southern Indians to enlist their support. In his absence Governor Harrison began the construction of a blockhouse on the ceded land where Terre Haute, Ind., now stands. After some friction with the Indians, he marched upon the Prophet's Town, and in the bloody Battle of Tippecanoe, near the site of Lafayette, he completely defeated the hostile Indians. The Prophet's Town was then completely destroyed. This ended forever Tecumseh's dream of a powerful Indian confederacy. (*See* Harrison, William Henry.)

Next year the War of 1812 broke out, and Tecumseh joined the British. He brought a large force of Indians to their support in Canada, and was given a commission in the English service. Fighting side by side with white soldiers he distinguished himself not only by his bravery and skill as a warrior, but by the humanity which he showed toward his foes. At the siege of Fort Meigs, for instance, he prevented a terrible massacre of the American prisoners. After playing an important part in several other engagements, he met his death in the Battle of the Thames, while bravely resisting an attack of American cavalry under Col. Richard M. Johnson of Kentucky. He was one of the greatest of American Indians, with a superb body, a powerful mind, and the soul of a hero.

TEETH. Two rows of sturdy workmen stand at the entrance of the digestive tract. When these workmen are well cared for they have the shiniest of white caps, which make them a joy to look upon. And when they are not well cared for we know at once that the owner is careless or else he does not realize that a slovenly looking servant is usually a poor workman.

These workmen are the teeth, and there are 32 of them—16 standing in each jaw—when they are all on duty. Up until we are six years old we have only 20 of these workmen. And these do not all come on duty at the same time. Instead they come two at a time, about every three months, until all 20 have appeared by the time we are three years old. We then keep this company of workmen (called the "milk teeth") about three years, after which we begin discharging them, two at a time, to make room for a new and stronger company which is slowly forming.

Do you know how this is accomplished? The new workman who wants to come in just cuts off the food supply of the first, so that he becomes so weak that he almost falls out of line of his own accord. This method is kept up until by the time we are 17 to 25 years old we have a whole new company of workmen, with a dozen extra—making 32 in all. These workmen also come in pairs, or double pairs, in each jaw. And we name them according to the work that they do.

At the front in each jaw are the four biting or cutting teeth (the "incisors"). Next to them on each side is a tall slim tooth whose business it is to tear things. We call these the "canine" or "dog teeth": in the upper jaw they are called the "eye teeth" because they are just below the centers of the eyes. Standing next to these on each side and in each jaw are two "bicuspid" or two-pointed teeth (the "premolars"). Next and last come the "molars," the teeth which do most of the grinding. There are three molars on each side, the third molars or "wisdom teeth" usually appearing between the ages of 16 and 20. These complete our permanent teeth—16 in each jaw, or 32 in all. They stay on duty as long as we live, if we treat them properly.

The Parts of a Tooth

When we look at a human tooth more closely we find that it has three parts, the crown or part which we see and which is covered with hard white enamel, the neck, and the root, which is buried in a socket in the jaw bone. Beneath the crown lies a hard bony substance called "dentine." And underneath this is a hollow filled with tooth-pulp. This is really a mesh of blood-vessels and nerves—which tells us at once how the tooth is fed, and why we have toothache when we break the enamel and the dentine decays so as to expose the delicate nerves.

From the structure of the teeth we can tell the food and the habits of any animal—whether they are beasts of prey and live on animal food, or whether they are grazers, or gnawers, or the like. Fishes and snakes have sharp teeth which do not rest in a socket; in crocodiles they do. Birds today do not have teeth,

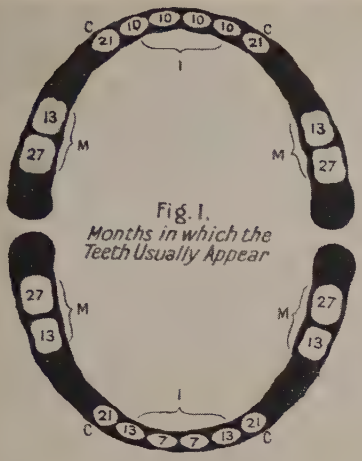


Fig. 1.
Months in which the Teeth Usually Appear

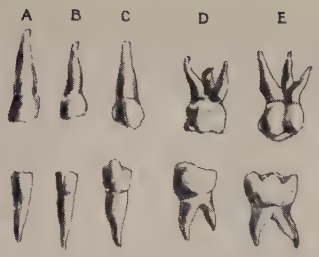


Fig. 2.
Examples of Milk Teeth

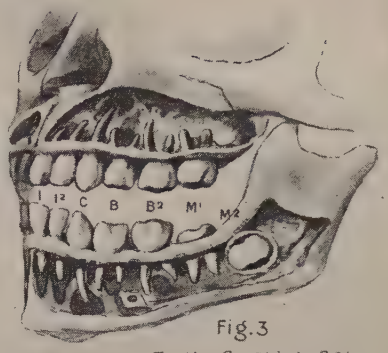


Fig. 3
Teeth of a Child of Six

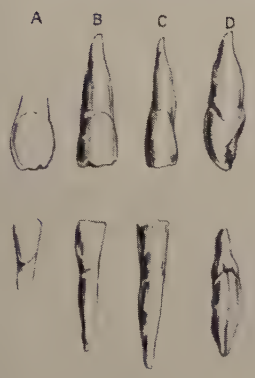


Fig. 4.
Incisors

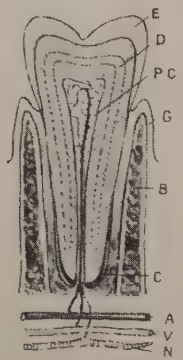


Fig. 6.
Vertical Section of a Tooth

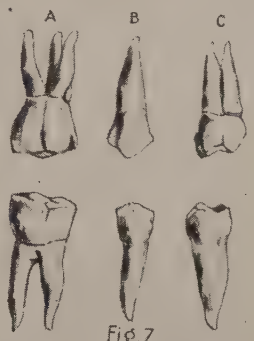


Fig. 7.
First Molar and First Bicuspid

Fig. 5
Canine

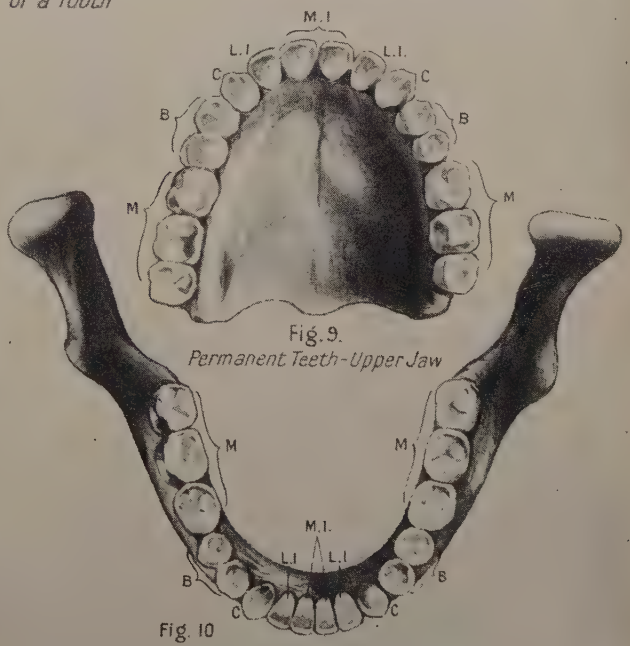


Fig. 9.
Permanent Teeth - Upper Jaw

Fig. 10
Permanent Teeth - Lower Jaw

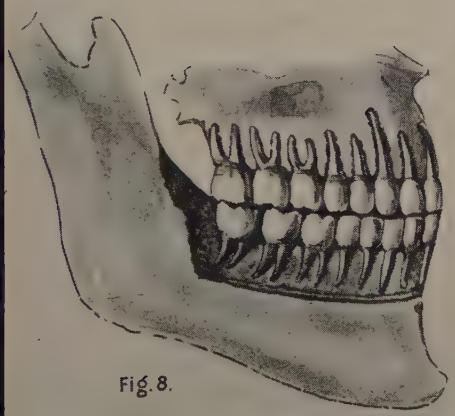


Fig. 8.
Teeth in Position

These pictures trace the development of teeth from childhood, their structure and arrangement. For identifying the teeth, I means incisor, C means canine, B means bicuspid, and M means molar. Fig. 1 shows that the lower incisors or front teeth are the first to appear in an infant, usually cutting through about the 7th month, and the others follow in the months numbered. Fig. 2 shows the shape of the various milk teeth from the incisors (A) to the molars (E). Fig. 3 shows the arrival of the first permanent tooth (M^1) which arises behind the milk teeth, the second molar being still buried. Figs. 4, 5, and 7 show the shape of the various permanent teeth. In Fig. 6 we see the structure of tooth and socket—E, enamel; D, layers of dentine; PC, pulp cavity; G, gum; B, bone; C, cement surrounding root; A, artery feeding blood to the tooth; V, vein carrying away blood; and N, the nerve, the last three all running into the pulp cavity. Figs. 8, 9, and 10 show the arrangement of the 32 teeth of an adult.

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though some fossil species had them. The great "cutting" teeth of beavers are just modified incisors, and so are the ivory tusks of elephants.

We need to keep our teeth clean, not only because unclean teeth look slovenly, but because the accumulations of food particles between them give rise to decay, causing toothache and early loss of teeth. Great care should be taken not to break the enamel by cracking nuts with the teeth and otherwise abusing them. Sudden changes from hot to cold liquids are very injurious to the enamel too. The gums as well need care or they will be attacked by a bacterial disease called "pyorrhoea," which causes the gums to recede from the roots with the result that the teeth become loose and finally fall out or have to be extracted. Also pus from the root sockets is carried by the blood to other parts of the body, causing rheumatism, heart disease, and many other ills. The teeth should be carefully brushed on the inside and out twice each day, morning and evening. A brush of medium texture with bristles of uneven length is best. The handle should be rotated and moved up and down in brushing so that the bristles will sweep vertically over and between the teeth and reach every little corner. A good powder or paste should be used, possibly replaced by a mouth wash at night. Overbrushing must also be guarded against lest the gums and necks of the teeth be injured. The family dentist should be visited at least once a year, so that decayed spots may be cared for as soon as they appear.

The FLASHING WIRES *that Gird the Earth*

The Miracle of the Telegraph and How it Carries Messages with the Speed of Lightning—The Story of Ancient Signal Systems—Morse's Great Invention and How It Works

TELEGRAPH. When George Washington died, it was weeks before the news reached some of the remoter settlements of the United States. Today every important event that occurs anywhere in the United States or the great cities of the world is flashed to every other city in the space of a few seconds, or at the most, a few minutes.

For thousands of years men have been experimenting with methods of telegraphing, that is, sending news by signals to distant places (from the Greek words meaning "to write at a distance"). Earliest of these devices was the signal light or beacon fire. You recall how Paul Revere, before starting on his midnight ride, arranged lantern signals from the belfry of Old North Church tower to tell of the coming of the British—"one if by land, two if by sea." When the great Spanish Armada threatened to land on England's shore, beacon fires were lighted on the hills of England's seacoast to call the protectors of England to arm and assemble.

Sunlight flashed from mirrors of glass or polished metal according to code signals is another ancient device for telegraphing. Napoleon used these light signals, or "heliographs," for communicating military orders, especially in his Egyptian campaigns. North American Indians made use of puffs of smoke, made by holding blankets over fires and releasing them at intervals. Semaphore signals somewhat like the signals used by railroads today were in general use in the 18th century throughout Europe, especially in France and Russia. (*See* Signaling.)

But these pioneer telegraph systems were all dwarfed to insignificance by the invention of the electric telegraph, about the middle of the 19th century. Almost as soon as men began to investigate electricity the idea of using it for sending messages was born. Franklin and others experimented with the Leyden jars, but not until the time of Sir Charles Wheatstone and Sir William Cooke in England, and Morse in the United States, was any practical system of telegraphy devised. Of the rival systems, that of Morse was the best and the one which has developed into the modern telegraph system (*see* Morse, Samuel F. B.).

Morse completed a working model of his epoch-making invention in 1835. He filed caveat for patent in the United States in 1837, and in 1844 the first telegraph line for commercial purposes was built between Washington and Baltimore. As in the case of most startling inventions, people were skeptical about Morse's device and heaped ridicule on the idea that messages could be actually carried over wires in such a mysterious way. Operation was at first unprofitable and development was slow. But the railroads soon adopted the new device to aid in the running of trains. Today the United States is crossed in every direction by a network of wires—more than 2,000,000 miles of them—over which pass many millions of messages a year. Wires have been laid from continent to continent under the waters of the ocean (*see* Cables, Submarine), and the crowning glory of the telegraph has been reached in the conquering of space by the wireless systems. (*See* Wireless Telegraph.) Today a message may girdle the earth in less time than it would have taken to communicate between neighboring sections of the same city before the days of the telegraph and telephone.

A telegraph system, in its simplest form, consists of a dependable supply of electric current, a path over which the current may travel, and the apparatus for sending and receiving messages. In the early systems current was supplied by battery cells, but the invention of the dynamo and the storage battery has furnished a more steady and constant current for telegraph purposes (*see* Dynamo). Only one wire is needed to join one station with another, for the circuit is completed by "grounding" or connecting each terminal

"TELEGRAPHING" THROUGH THE AGES

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with a metal plate in the ground, and the return circuit is made through the earth.

The sending instrument or transmitter is simply a convenient means for opening and closing the electric circuit. When the key of the transmitter is pressed down the circuit is closed, and when the key is released a spring pulls it up and breaks the circuit. As the circuit is closed and opened, the current flows and stops; and the action of electricity is so lightning-swift that the opening and closing of a telegraph key in New York is recorded at the receiving instrument in San Francisco at almost the same instant. Quickly pressing down and releasing the lever represents the "dot" in the Morse code, and holding for a slight interval represents a "dash." The different arrangements of the dots and dashes represent letters and word signs necessary for the sending of messages. The code on telegraph systems in the United States is called the Morse code, although it has been changed and improved from the original form devised by Morse himself. The code used in other countries and for intercontinental messages is called the International code.

CABLING ACROSS THE SEA

Before the operator is a dispatch for Europe. Instead of printing letters, his "typewriter" perforates a tape, and the tape then causes the transmitting machine at the left to send the message along the cable.

At the other end of the circuit is the receiving instrument, or sounder. It was in the construction of the sounder that Morse made his big contribution, for he employed the newly discovered electromagnet, which made it possible to receive messages at distances so great that the current has become quite weak (*see* Magnet). When the current reaches the sounder, it flows through coils of wire wrapped around a bar of soft iron. This bar then becomes a magnet and attracts a metal bar on a lever, so adjusted that it strikes with a click. The instant the current ceases to flow, the magnetic force is lost and the lever is released and pulled up by a spring. As the circuit is rapidly closed and opened by the sending of the dots and the dashes from the key, the lever snaps down and up against metal stops, and clicks off the sounds which you hear in a telegraph office.

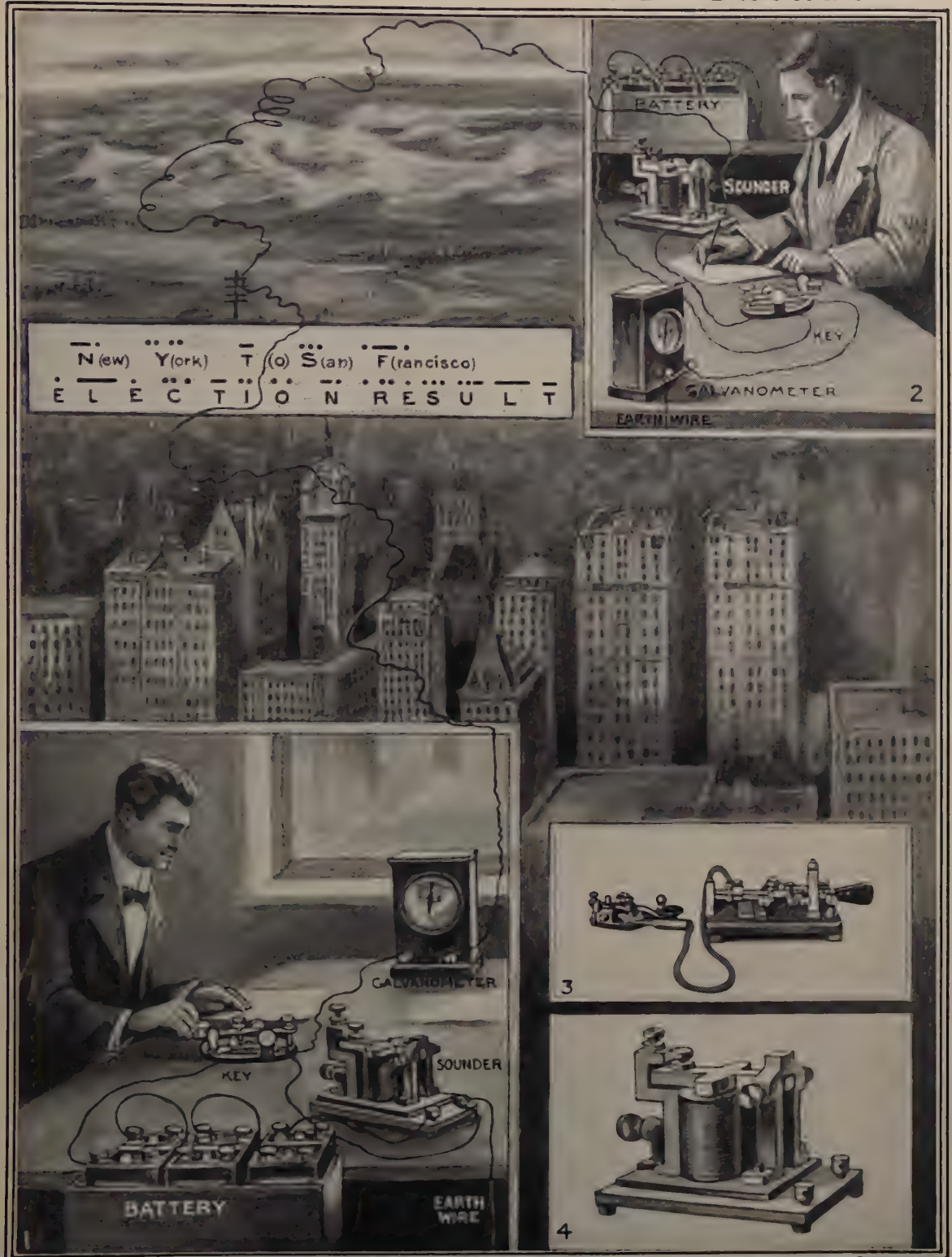
Morse's first receiver had a pen attached to the lever so as to mark on a strip of paper moved along regularly by clockwork—making short and long marks called the dots and dashes. But the telegraph operators were soon able to read the messages by simply listening to the clicking of the instrument, and the pen was discarded. Most messages are written out by the operator on a typewriter, but for purposes where a printed record of messages is wanted, as for example on the "ticker" instruments in banks and brokers' offices, which carry the stock market reports and other financial news, wonderful receiving instruments have been devised which print the letters on a long paper tape instead of clicking off dots and dashes.

In sending a message for any distance the current becomes too feeble to operate a sounder unaided. To meet this difficulty relays are used at the receiving station, and at intervening stations where necessary. The relay has an electromagnet like the one in the sounder, but the lever above this magnet is adjusted to respond to very feeble currents and is used simply to open and close the circuit of a local battery. Thus the current of the local battery flows and stops in exact time with the opening and closing of the main circuit, and its full strength is used to operate a sounder, repeating the message from the main line.

The building of a telegraph line requires expensive equipment and labor; hence it is desirable to increase the carrying capacity of each wire as much as possible. One way of doing this is by speeding up the sending of messages. A hand operator sends 50 words or more a minute, but automatic sending machines are capable of sending from 80 to 350 words a minute.

The most effective way of increasing the capacity of each wire, however, is by devices which make it possible to send several messages at a time and in both directions. A system arranged for sending one message in each direction at the same time is called duplex telegraphy. Where two messages are sent in each direction it is called a quadruplex system; and where the capacity is still greater we have a multiplex system. In the largest telegraph offices today wonderful sending machines are in use which are operated by keyboards like typewriters. The receiving machines print the messages automatically, each message appearing as correctly arranged as a typist could do it. This is called the automatic multiplex system. Four operators at each end of a single wire equipped with the automatic multiplex system can send 480 messages an hour, whereas the best Morse hand operator on a single wire averages only about 60 messages an hour.

THE STORY OF "DOTS" AND "DASHES"



Every time the sending operator (1) presses his key, the sounder at the right of the receiving operator (2) clicks. A quick double click is a "dot"; two clicks separated by a distinct interval is a "dash." The sample message shows how telegraphers abbreviate, using initials for cities, and so on. The "vibroplex" (3), sometimes called a "bug," is a device attached to the regulation sender, which makes sending easier, doing away with "telegrapher's cramp." "Dashes" are sent by pressing the key to the left; but when it is pressed to the right, a vibrating tongue sends dots automatically until the key is released. The standard sounder is shown below (4).

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A great central telegraph office like the Western Union office at Chicago is a sight of extraordinary interest. This office is the hub from which radiate some 800 main or trunk lines to the east, west, north, and south; and more than 70,000,000 messages go through it in a year. About 500 lines called "feeders" or "loops" connect it with the branch offices dotted over the city. The telegrams left at these branch offices are sent to the central office over the "feeders," and messages from other cities come in over the trunk lines to be relayed to their final destinations. Copies of these messages as they arrive are placed on automatic carriers for distribution to the proper outgoing wires. For example, a message to Detroit is placed in a pneumatic tube or on a moving belt which delivers it promptly to an operator sending over a Detroit wire; and under normal conditions the message will be received in Detroit in less than five minutes from the time it has reached the Chicago office.

After the operator has sent a message over the wire, the copy is filed and kept for a year, so that any time within a year it is possible to locate a particular message, if the date of the message and its destination are known.

Because of the importance of the telegraph systems in modern life, they are subject to public regulation just as are the railroads and other common carriers and public utilities. (*See* Interstate Commerce Commission; Public Utilities.)

A very ingenious modification of the telegraph, called the *telautograph*, is employed in many clubs, hotels, and large business establishments for transmitting written messages from one department to another. By the aid of this contrivance a pen at the receiving end writes an exact facsimile of the words written at the other end by the hand of the sender. Cords or levers attached to the transmitting pen are connected with a complicated electric mechanism. As they follow the movements of the pen they send out currents which vary in intensity according to the position of the pen, thus controlling the movement of the pen at the receiving end.

TEACHING ELECTRICITY *to* TALK

The Magic Instrument that Carries Every Tone and Accent of the Human Voice over Hundreds and Thousands of Miles—How the Telephone is Made and How It Works—The Mysteries of the Exchange

TELEPHONE. Think of the wonder of an instrument that can pick up your voice and carry it over a space of a mile, 10 miles, even 3,000 miles, so perfectly reproducing every inflection and tone that your friend at the other end of the wire instantly knows it is *your* voice, even before you tell him who is speaking!

How is it done? Before you can understand that, you must recall that when you speak your voice sets up waves in the air, which spread in every direction just as waves do in water when you drop a pebble into a still pool. When you speak into the transmitter of the telephone these sound waves strike against a disk and set it also to vibrating in time with the waves. The disk forms part of a circuit carrying a current of electricity, and the electric current is strengthened and weakened by the different vibrations of this disk. This sets up electric waves in the wire that match the sound waves exactly. In this way the electric current virtually catches up the sound waves and bears them swiftly, almost instantaneously, to the other end of the wire, no matter how far that may be. There the electric waves pass through electromagnets. The variations in the electric current cause the magnets to attract an iron disk with varying strength, and thus make it vibrate exactly like the transmitting disk against which you talk.

This last transformation, of course, takes place in the receiver of the telephone at the other end of the wire. Your friend's ear is placed near this disk and the vibrations it causes in the air create the sensation we know as sound. Carried to your friend's brain by the nerves, the sounds are there translated into words, and your friend understands what you are saying just as if you stood only a few feet from his side.

Your father can remember when only a few business offices and stores had telephones and there were fewer still in private dwellings. Your grandfather can easily recall when there were no telephones at all. It was not until 1875–76 that Alexander Graham Bell, experimenting with sound waves in search of a method by which deaf children might be taught to speak, found the secret of sending speech over long distances by means of electricity. Just two hours after Dr. Bell filed his application for a patent in Washington, D. C., Elisha Gray of Chicago, who had been working along similar lines, filed an application covering some of the same principles (*see* Bell, Alexander Graham).

Since that time the telephone has been improved by hundreds of inventions, virtually all of which were made by Americans. Many of these, however, are merely in the nature of expansions upon the idea first worked out by Dr. Bell and Mr. Gray.

But these two men were not the first to have an inkling that speech might be carried over long distances by electricity. In 1837 Charles G. Page of Massachusetts conceived the idea that electric current might carry sound, but he did not develop the thought. In 1860 Johann Philip Reis, a German, actually constructed an electrical telephone, but gave up the effort, owing to what seemed insurmountable obstacles to making it practical.

So it was left to Dr. Bell to produce the first telephone that really worked. It was exhibited at the Centennial Exposition at Philadelphia in 1876, and

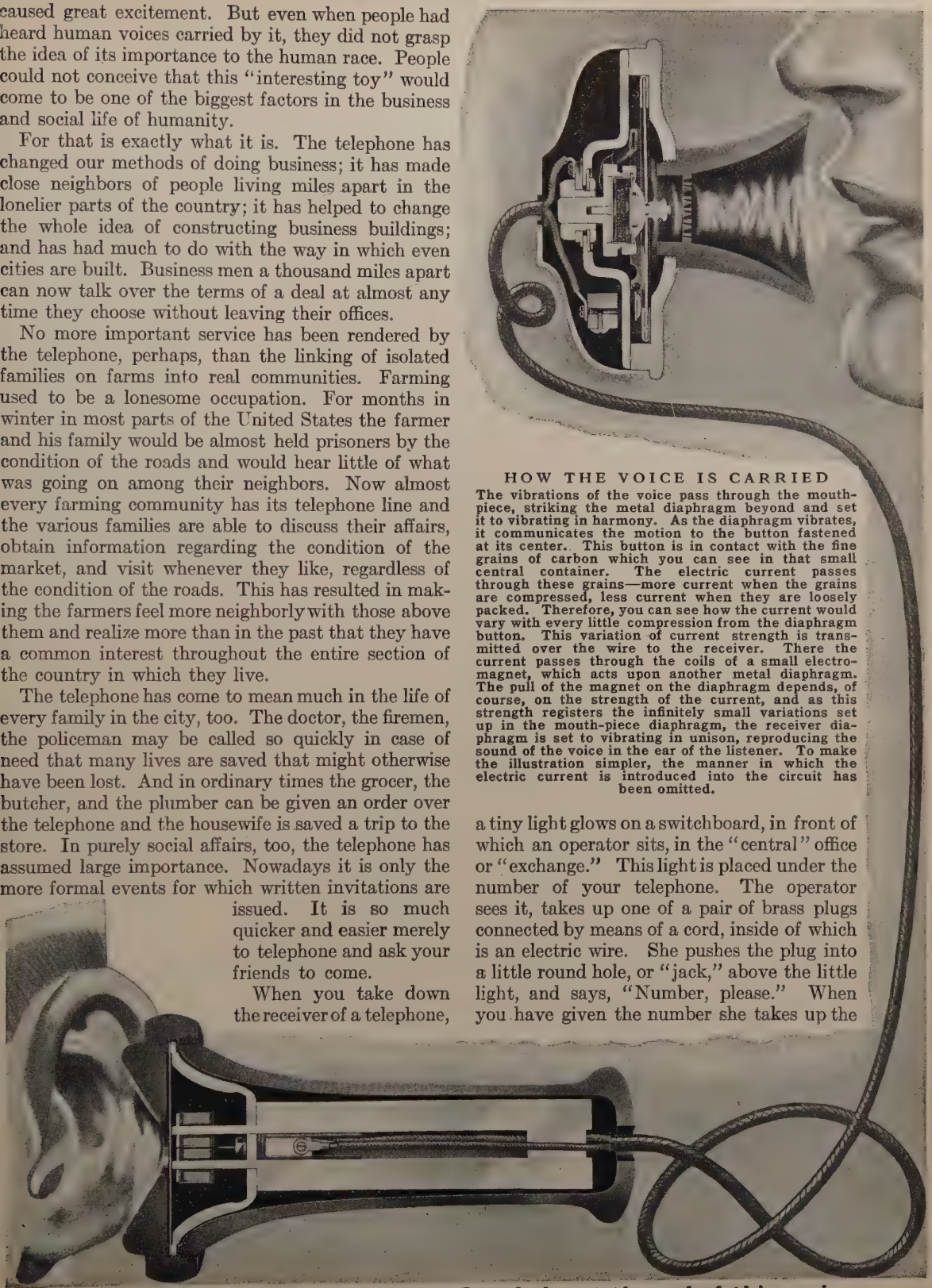
caused great excitement. But even when people had heard human voices carried by it, they did not grasp the idea of its importance to the human race. People could not conceive that this "interesting toy" would come to be one of the biggest factors in the business and social life of humanity.

For that is exactly what it is. The telephone has changed our methods of doing business; it has made close neighbors of people living miles apart in the lonelier parts of the country; it has helped to change the whole idea of constructing business buildings; and has had much to do with the way in which even cities are built. Business men a thousand miles apart can now talk over the terms of a deal at almost any time they choose without leaving their offices.

No more important service has been rendered by the telephone, perhaps, than the linking of isolated families on farms into real communities. Farming used to be a lonesome occupation. For months in winter in most parts of the United States the farmer and his family would be almost held prisoners by the condition of the roads and would hear little of what was going on among their neighbors. Now almost every farming community has its telephone line and the various families are able to discuss their affairs, obtain information regarding the condition of the market, and visit whenever they like, regardless of the condition of the roads. This has resulted in making the farmers feel more neighborly with those above them and realize more than in the past that they have a common interest throughout the entire section of the country in which they live.

The telephone has come to mean much in the life of every family in the city, too. The doctor, the firemen, the policeman may be called so quickly in case of need that many lives are saved that might otherwise have been lost. And in ordinary times the grocer, the butcher, and the plumber can be given an order over the telephone and the housewife is saved a trip to the store. In purely social affairs, too, the telephone has assumed large importance. Nowadays it is only the more formal events for which written invitations are issued. It is so much quicker and easier merely to telephone and ask your friends to come.

When you take down the receiver of a telephone, a tiny light glows on a switchboard, in front of which an operator sits, in the "central" office or "exchange." This light is placed under the number of your telephone. The operator sees it, takes up one of a pair of brass plugs connected by means of a cord, inside of which is an electric wire. She pushes the plug into a little round hole, or "jack," above the little light, and says, "Number, please." When you have given the number she takes up the



HOW THE VOICE IS CARRIED

The vibrations of the voice pass through the mouth-piece, striking the metal diaphragm beyond and set it to vibrating in harmony. As the diaphragm vibrates, it communicates the motion to the button fastened at its center. This button is in contact with the fine grains of carbon which you can see in that small central container. The electric current passes through these grains—more current when the grains are compressed, less current when they are loosely packed. Therefore, you can see how the current would vary with every little compression from the diaphragm button. This variation of current strength is transmitted over the wire to the receiver. There the current passes through the coils of a small electro-magnet, which acts upon another metal diaphragm. The pull of the magnet on the diaphragm depends, of course, on the strength of the current, and as this strength registers the infinitely small variations set up in the mouth-piece diaphragm, the receiver diaphragm is set to vibrating in unison, reproducing the sound of the voice in the ear of the listener. To make the illustration simpler, the manner in which the electric current is introduced into the circuit has been omitted.

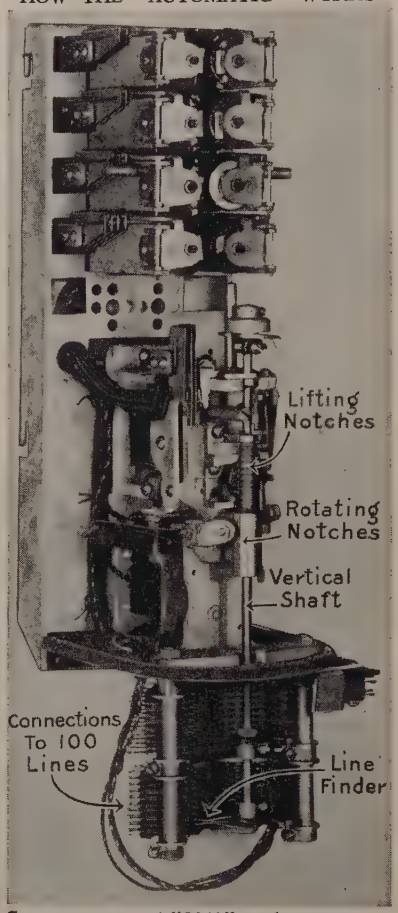
plug that is the companion to the first one, and touches it to the edge of a hole bearing the number you have asked for. If she hears a clicking sound she knows that line is in use and tells you, "Line is busy." If no sound is heard, she pushes the plug into the hole and presses a button that causes the bell on the telephone to ring. When the person at that end of the wire takes down the receiver you can begin to talk.

That is all there is to it if the number you are calling is in the same exchange as your own. But in large cities there will be a number of exchanges with different names, such as "Main," "Franklin," and so on. If your friend's telephone is connected with one of these other exchanges, the operator who takes the number from you presses a button which enables her to talk over a specially provided wire with the operator in the exchange with which that number is connected, and asks for the number. The operator in the second exchange picks out a trunk line connecting the two exchange offices. All exchanges are connected by such trunk lines.

Then the operator in your exchange picks up the companion to the plug she inserted in the hole above your little light and pushes it into the hole connected with the trunk line. After that the second operator inserts a plug in the hole of the number you are calling, and your friend's telephone bell begins to ring. That sounds like a long process, but it actually takes only a few seconds.

The telephone exchanges, or "central offices" as we often call them, are intensely interesting places. In a large exchange there will be a score or more of young women operators, seated in long rows before the switchboards, each with a receiver held to her ear by means of a clamp over the head and a peculiarly shaped transmitter suspended about her neck, so that it is always within a few inches of her mouth. The face of the switchboard is somewhat like a honey-comb with its many little holes, while the tiny lights flash here and there over its surface like fireflies, the operator responding to every one of their silent calls. But with all the busy traffic of connections asked for and given, questions asked and answered, there is no real noise in a big telephone exchange, only a quiet and continuous murmur.

HOW THE "AUTOMATIC" WORKS



Suppose you want "8942" on the automatic. When you "pull" the dial to "8," it sends eight impulses to the machine, and pulling "9" sends nine impulses. These impulses rotate and lift the vertical shaft by the corresponding number of notches, and the "line finder" is brought in contact with the connection which handles the "89-hundreds." Pulling "4" and "2" causes a second machine to complete the second half of the connection in a similar way.

The miles upon miles of wire making up the trunk lines and subscribers' lines in a great city are not seen in the business district. There they are carried underground in conduits. Out in the less congested sections of the city and in the suburbs, they generally emerge from the earth and run through cables held up by tall poles.

In addition to the telephone system in each city or town, there is, of course, the great system of long-distance telephones which links the whole into one gigantic network of communication that covers practically every part of the United States. Trunk lines connect the different cities and towns, just as shorter trunk lines connect the various exchanges in a single city. So when a subscriber in New York, for instance, wants to talk to a man in Chicago, he asks the operator in his exchange to connect him with "long distance." He tells the "long distance" operator the name of the Chicago man with whom he wishes to talk. The operator has the telephone directories of all the cities and towns where she can get them. In the Chicago directory she finds the name of the man the New York subscriber is calling, gets his number, and then, by means of a trunk line, establishes a connection with a "long distance" operator in Chicago. She gives this operator the number of the man wanted and she completes the connection.

Through the perfection of appliances to strengthen the electric current it is now possible to talk without difficulty from New York to San Francisco, a distance of 3,000 miles (*see* Audion).

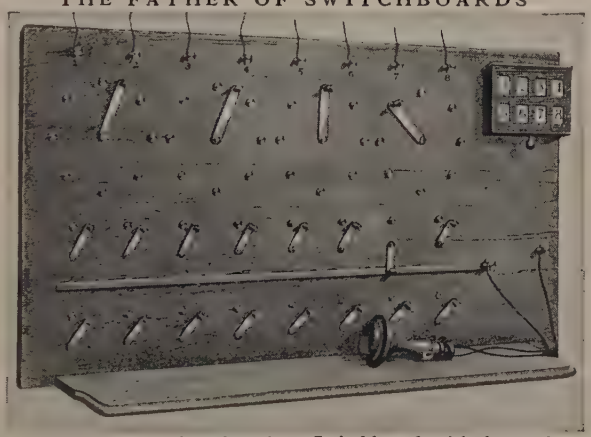
The invention of "automatic exchange systems" has made it possible where such systems have been installed for subscribers within a city to telephone one another without the aid of the telephone operators. The person desiring to call sets this wonderful electrical device in motion by moving a dial attached to his telephone to each numeral of the number he wishes to call, and letting it turn back to its starting position after each numeral. Then the machinery in the exchange office, without further aid from any human hand, selects the line desired and starts the bell ringing, or, if the line is busy, indicates the fact by making a peculiar noise. It is necessary, of course, to have operators for "long distance" service.

WHERE YOUR CALLS FOR OTHER EXCHANGES ARE HANDLED

This is a "B-board" in a telephone exchange, where calls from other exchanges are handled. Suppose your telephone is "Main 4321" and you want "West 590." The operator who answers you (called an "A-operator") "plugs in" on a special line to the "B-board" in the "West" exchange. When the "B-operator" answers, your operator says "Main 590," which indicates that the call is from the "Main" exchange and for the "West" number. The "B-operator" selects a vacant trunk line between the exchanges and gives its number to your operator. Your line is connected to one end of this trunk, the other end is connected to "590" in the "West" exchange, provided it's not busy, and the connection is complete.

So prodigious has been the growth of the telephone business since Dr. Bell produced his first awkward instrument that there are now more than 10,000 telephone companies in the United States alone. A number of these are members of the Bell system, the greatest of the telephone concerns and the one that originally owned the patents on Dr. Bell's inventions. More than 9,000 independent telephone companies have connections with the Bell system, giving their subscribers the use of the Bell lines, and there are approximately 1,000 independent companies having no connection with the Bell system wires. In addition to these, there are many rural telephone lines and associations that operate their own lines but are not classed as companies. Of these more than 26,000 have connections with the Bell system. The Bell system alone connects with about 13,000,000 telephones, owns more than 26,000,000 miles of wire, and employs 230,000 workers. In no other country in the world is the telephone so generally in use as in the United States. In part, no doubt, this is due to the fact that it is an American invention, but also it is because it fits the American temperament.

THE FATHER OF SWITCHBOARDS

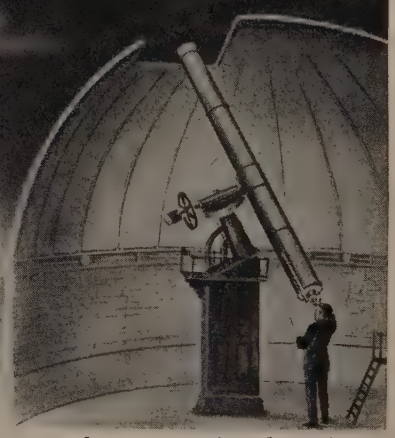


Contrast this, the first American Switchboard, with the modern installation above. This board was used in New Haven, Conn., in an exchange serving eight subscribers.

Wonderful as it is, the telephone is not considered perfect by the telephone companies, and constant efforts are made to improve it. The Bell system maintains a department of development and research in which engineers devote all their time to devising and testing improvements in the wire, electrical appliances, and methods of construction. In a single recent year these men worked on 500 distinct improvements.

In recent years much attention has been given to the development of the wireless telephone. (*See* Wireless Telegraph and Telephone.)

The MAGIC GLASS that HELPS US FIND NEW WORLDS



TELESCOPE. When Galileo, with the aid of the telescope which he had invented (1609), scanned for the first time the heavens, it was—in the words of an eminent American astronomer—"an adventure comparable to a voyage across an unknown sea, and the discoveries made with it were as marvelous as the new lands which Columbus and his followers found by sailing westward from Europe." Within a short time Galileo's new invention enabled him to discover four of the moons which circle about Jupiter, the rings of Saturn, mountains and plains on the moon, spots on the sun, and the rotation of that mighty body itself on its axis.

In essential elements the telescope is simply (1) a convex lens (the "objective") or a concave mirror (the reflector or "speculum") set in one end of a tube to focus the light from a distant object, producing a bright image; and (2) a lens called the "eyepiece" to magnify this image and bring it to the eye. If the telescope has a convex lens (objective) it is a "refracting" telescope; if it has a speculum, it is a "reflecting" telescope. The refracting telescope is the older type; and while Roger Bacon about 1280 showed that he had sound ideas about the theory of such a telescope, and opticians in Holland actually made such instruments a year or two before Galileo, the credit for the invention is usually given to this great Italian astronomer.

How a Refracting Telescope Works

When the telescope is pointed at a star, the light rays enter the telescope as essentially parallel lines. They are brought to a focus (*F*) by the objective (*O*), and then pass through the eyepiece (*E*), and emerge again in parallel lines. But the *large* cylinder of rays which enters through the objective is condensed to a *small* cylinder by the time it emerges from the eyepiece. Consequently many more rays of light enter the eye than would enter without the telescope, and this has the result of greatly increasing the apparent brightness of the star. So we may say that the effect of a great telescope such as that of the Yerkes Observatory, with its 40-inch objective, is to give a pupil to our eye which is many thousand times as powerful as our natural one!

Early refracting telescopes were subject to two serious drawbacks. The images they produced were distorted, first, because the rays passing through the margin of the lens were brought to a focus before the others (spherical aberration), and second, because the blue rays were brought to a focus before the red (chromatic aberration). It was almost 150 years before an English optician discovered that these defects could be overcome by making the objective of two pieces of glass, the outer piece convex and made of crown glass, and the inner concave and made of flint glass. Meanwhile the reflecting telescope, invented in 1669 by Sir Isaac Newton, had come into use.

In the Newtonian reflecting telescope the light passes the entire length of the tube to a curved mirror, called the "speculum," which reflects the rays back in the shape of a cone to a prism or diagonal reflector. The prism diverts the rays at right angles to an eyepiece at the side of the tube. Such a telescope is free from chromatic aberration, but the position of the eyepiece makes it more awkward to use. In another form of reflecting telescope, the Cassegrainian, the cone of rays reflected from the speculum is intercepted by another curved mirror placed near the other end and reflected back through a hole in the center of the speculum to the eyepiece.

For any subject not found in its alphabetical place see information

Both reflecting and refracting telescopes are used in modern astronomical observatories. The advantages of the reflector are its cheapness and its perfect "achromatism" (freedom from outside colors), while the main advantage of a refractor is its permanence and freedom from trouble after once being well adjusted. The largest telescopes in the world are reflectors; the king of them all is the 100-inch reflector at Mount Wilson, Calif. A practical drawback to the reflector is that the speculum tarnishes and needs occasional repolishing if of metal and resilvering if of glass.

The magnifying power of a telescope is expressed in diameters. The focal length (*see* Lens) of the objective or speculum, divided by the focal length of the eyepiece, gives the magnifying power, and every telescope has eyepieces giving various powers. Why not use always the highest power possible? Because imperfections are magnified with the image, and the image loses in brilliancy as it gains in size. Consequently, a faint object can only be magnified up to a certain degree, because further magnification would make it too dim to be seen well. The mammoth Yerkes 40-inch refractor can be used advantageously to give 1,000 diameters, and higher powers are possible.

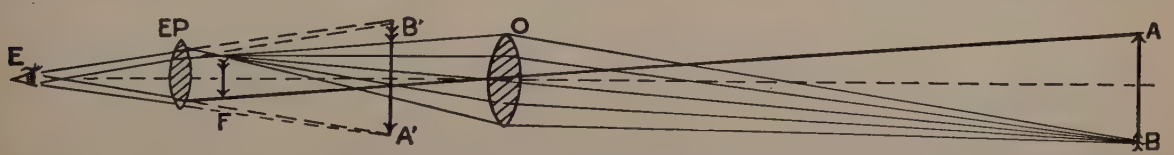
The most important part of a telescope, a great astronomer says, "is the man at the small end." Next in importance is the objective lens or the speculum; this must be made with almost miraculous precision. The surface must be accurate to the fifty-thousandth part of an inch, and months, even years, of labor are often required to cast and polish a single objective (*see* Glass). So sensitive to changes of temperature is the great 9,000-pound 100-inch mirror at Mount Wilson, Calif., that it is kept in a water jacket during the daytime. The mounting and controlling mechanisms of telescopes are also marvels of human ingenuity (*see* Observatory). Many modern telescopes are so constructed that measurements of objects and spaces in the field may be made in thousandths of an inch, by means of the micrometer (*see* Micrometer).

A TOWER TELESCOPE

The instruments are fixed on the ground, and a mirror in the top of the tower reflects the image of the sun down the tube to them. The tower is part of the Mt. Wilson Observatory.

In all astronomical telescopes, the image seen at the eyepiece is inverted. In the smaller telescopes or spyglasses to be used on land, an additional lens or system of lenses has to be introduced to re-invert the image, so that it is seen in the same position as the object. The opera or field glass is a pair of small telescopes with concave lenses for the eyepieces. The most efficient and modern instrument of this type, called the prism field glass or "binocular," has two reflecting prisms in each tube. This gives it as much magnifying power as could be obtained with an ordinary field glass three times as long, besides permitting the use of a better type of eyepiece which gives a much larger field of view with better definition.

Tell, William. In the marketplace of Altdorf, Switzerland, in the days when the Hapsburgs ruled those cantons, a hard and cruel Austrian governor named Gessler —so the legends say—set up a long pole on which he placed a hat to symbolize the Austrian power; and he proclaimed that everyone who passed must bow the knee and bend the head as to the Count of Hapsburg himself.



This diagram illustrates how the astronomical telescope works. Let us suppose we are viewing the moon or one of the planets, represented by the arrow (AB). The object glass (O) brings the image of AB to an inverted focus at F, where it is viewed by the enlarging eyepiece (EP), which represents it to the eye as though it were a large near object (B'A'). The radiating lines from B indicate how light rays are focused by the object glass. Viewed with the naked eye, comparatively few of the rays from B would be seen, but with the lens (O) in the way, virtually all the light from B which strikes the surface of that lens is brought together again at the upper end of F. The larger the lens, of course, the more light it collects and the more powerful it is for astronomical purposes.

HOW THE CRUEL GESSLER CAME TO HIS DEATH

The legend of William Tell is told in folk lore with many different endings. According to the version pictured here, Gessler continued oppressing the people, and Tell was called upon to rid them of the tyrant. Lying in wait for Gessler along a forest road, he shot and killed the bailiff with his crossbow.

One day William Tell, who was as fearless and honest and as noble-hearted as he was skilled with the crossbow, passed by with his little son Walter. He refused to obey this despotic order, so he was arrested by the soldiers guarding the pole and dragged before the cruel governor.

Gessler, when he had heard the charge against Tell, said scornfully: "I hear you are a great shot. They say that you can shoot an apple from a twig at a hundred paces." Then, smiling cruelly, he went on: "I have heard so much of this boast that I should like to see something of it. But instead of a twig, we will place the apple on your son's head, and you shall shoot at that mark."

Tell turned pale and said that he would rather die. "You shall shoot," said Gessler, "or you and the boy shall both die. Bind the boy to a tree," he ordered.

Brave little Walter let himself be bound and stood quite still, sure that his father could not miss the mark. Tell took an arrow from his quiver, examined it carefully, and slipped it under his belt. Then he took another and fitted it to his bow. All were breathless as the shaft sped through the air and pierced the heart of the apple.

"A good shot!" cried Gessler who watched with a wicked smile. "But for what was the other arrow?"

"To slay you, tyrant, had I killed my son," was the reply.

In a rage Gessler commanded his soldiers to seize and bind Tell, and carry him to a prison across the lake. But during a storm which arose Tell escaped, and soon after he slew the tyrannical governor. The legend places these events in the year 1307, and it was soon after this, in 1315, that the men of the three forest-cantons—Uri, Schwyz, and Unterwalden—defeated an invading Austrian army and then renewed and enlarged the Perpetual League, which laid the foundations of Swiss independence.

For any subject not found in its alphabetical place see information

Though the story of William Tell was long accepted as historically true, it is now known that it is merely one of those great patriotic legends that grow up in every land. The story of an archer who shot an apple from his son's head is found in at least five places outside of Switzerland, and the answer which the archer gives the tyrant is in each case about identical with that given Gessler by Tell. In Swiss literature the story is first found about 1474. Records of the district about Altdorf show no trace of a governor named Gessler. The German poet Schiller used the legend in his drama 'Wilhelm Tell'.

TEMPERANCE. At first "temperance" meant merely the movement to secure moderation in the use of intoxicating drinks. Gradually its scope extended to include total abstinence from their use ("teetotalism"). The first temperance society in the United States was formed at Litchfield, Conn., in 1789, by 200 farmers who pledged themselves not to give strong liquors to workmen engaged in carrying on their farm work. Early in the 19th century the churches took a hand. The Massachusetts Temperance Society was begun in 1813, and the American Temperance Union in 1826. The early societies were temperance societies, but not total abstinence societies. They did not object to the use of wine, cider, or malt liquors. The temperance reformers even built a brewery in Boston as a means of combatting the use of distilled liquors. The first national temperance convention met in Philadelphia in 1833, and formed a national temperance union, with 23 state societies and over 7,000 other societies as members. The temperance cause had a great set-back during the Civil War when through preoccupation with other questions the people for the time lost interest in the subject. After the war, the growth of breweries and the starting of many attractively decorated and well furnished saloons brought the temperance question again before the people. The "total abstinence" idea was first insisted upon by the Massachusetts society in 1823, and gradually became the slogan of practically all temperance societies. With the adoption in January 1919 of the constitutional amendment establishing nation-wide prohibition, the problem of temperance for the United States was practically solved. (*See* Prohibition; Woman's Christian Temperance Union.)

'TEMPEST, THE'. On an island in the Mediterranean Sea, according to this romantic play by Shakespeare, lives an exiled duke of Milan, Prospero, with no companions save his lovely daughter Miranda, and his books of philosophy and magic. By his magical knowledge, he brings into his service an ugly, half-human creature called Caliban, and the fairy spirit Ariel. One day Prospero discerns a ship blown toward the island, and knowing by his magic that the King and the Prince of Naples, as well as his own false brother, the usurper of his dukedom, are on board, he sends Ariel to wash them into the sea and land them safely on different parts of the island. It is Prospero's hope to bring about a marriage between Miranda, whom he has tutored with care from her infancy, and the young Prince of Naples. To his great joy not only do the youthful pair, as soon as they meet, fall to adoring each other, but the King himself is delighted and restores to Prospero his dukedom. Some people like to think that Prospero is Shakespeare, who with this play laid down his pen forever, as Prospero, at the end, breaks his magic wand and sets free the delicate powerful spirit, Ariel, or Imagination, who sings in sweet and lilting tones:

> Where the bee sucks, there suck I:
> In a cowslip's bell I lie;
> There I couch where owls do cry.
> On the bat's back I do fly
> After summer merrily.
> Merrily, merrily shall I live now
> Under the blossom that hangs on the bough.

The "BIG BEND" STATE—*Its Corn, Cotton, and Coal*

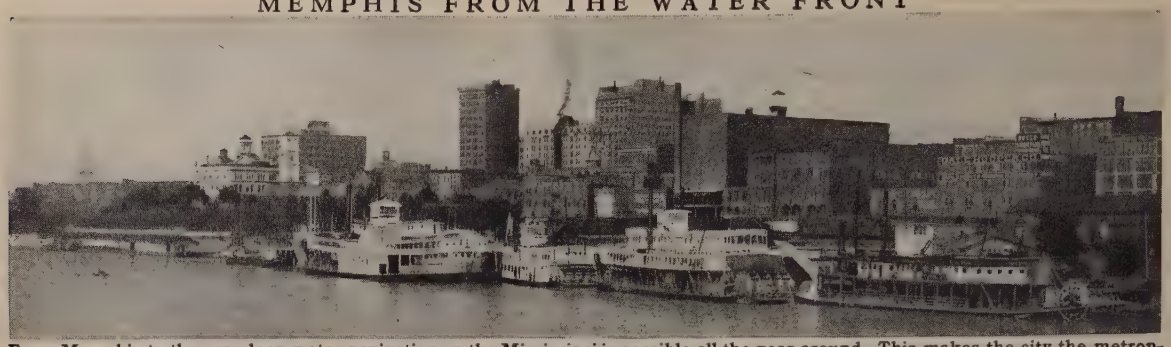
TENNESSEE. A long narrow strip of land, wedged in among eight other states, Tennessee extends 432 miles from the Mississippi River eastward into the Appalachian mountain system. Its surface is remarkably diversified, falling into three divisions, east, middle, and west Tennessee. The Cumberland Plateau, a continuation of the great Appalachian Plateau, marks the division line between east and middle Tennessee, and Lower Tennessee River separates middle and west Tennessee.

Extent.—East and west, 432 miles; north and south, 110 miles. Area, 42,022 square miles. Population (1920 census), 2,337,885.
Natural Features.—Great Smoky (Unaka) Mountains, along the eastern border, separated from the Cumberland Plateau by the valley of the Tennessee (highest point, Mount Guyot, 6,636 feet); central and western Tennessee, rolling country and plains, sloping to the Mississippi. Chief rivers: Tennessee, Cumberland, and Mississippi.
Products.—Corn, wheat, cotton, hay, tobacco, fruits and vegetables; lumber and timber products, iron and steel, hosiery and knit goods, cottonseed products, flour and other food preparations; coal, zinc, copper, marble, and clay products.
Chief Cities.—Memphis (about 165,000), Nashville (capital, 120,000), Knoxville (80,000), Chattanooga (60,000).

East Tennessee is a valley 30 to 60 miles wide, the southwestward extension of the great Appalachian valley. It lies between the steep slope of the Cumberland Plateau on the west, and on the east the Unaka or Great Smoky Mountains, the southern end of the Blue Ridge. Minor ridges and valleys furrow it from end to end. While portions of the mountainous sections are unproductive, most of the beautiful valley of eastern Tennessee is very fertile and compares favorably in productivity with the rich lands of middle and western Tennessee.

Two of the large cities of the state are in this valley, Knoxville, near the center, and Chattanooga near the southern border. Located in the heart of hardwood, coal, marble, copper, and zinc-producing sections, Knoxville has recently gained great commercial and

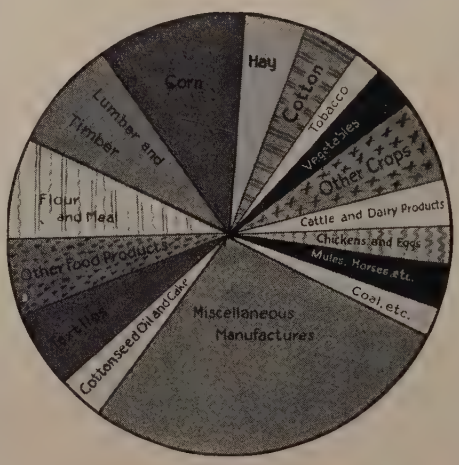
MEMPHIS FROM THE WATER FRONT



From Memphis to the sea, deep-water navigation on the Mississippi is possible all the year around. This makes the city the metropolis, not only of Tennessee, but of the whole Mississippi Valley between St. Louis and New Orleans.

industrial importance, more than doubling its population between 1910 and 1920. Eighty miles south is Chattanooga, at the point where the Tennessee River leaves the Appalachian valley and enters the Cumberland Plateau. As the natural gateway between Tennessee, Alabama, and Georgia, Chattanooga was one of the most important strategic points in the Civil War, and near it were fought a series of famous battles (*see* Chattanooga, Battle of). The vast amount of hydro-electric power available here, with adjacent forests and deposits of coal, iron, and other minerals, is making Chattanooga one of the great cities of the new industrial South.

The Cumberland Plateau, rising abruptly from 900 to 2,000 feet above the valley, is from 50 to 70 miles wide. It is rich in water-power, mineral springs, and mineral resources in general. Health resorts have grown up around many of the mineral springs. Its southern end is deeply cut by the Sequatchie valley, 60 miles long and 3 to 5 miles wide.



Relative Value of Tennessee's Products

Middle Tennessee, dropping abruptly from the irregular jagged edge of the Plateau, is for the most part a level plain furrowed by many ravines and streams, sloping to the Central Basin, an elliptical depression of about 5,000 square miles, extending nearly across the state from northeast to southwest. This is the "garden of Tennessee," containing the finest farming lands. In its northwestern part, on the Cumberland River, is Nashville, the capital and second largest city (*see* Nashville).

Beyond the valley of the Lower Tennessee, the western part of the state slopes gently down to the Mississippi River, the plain terminating sharply in a line of bluffs overlooking the alluvial bottom lands —low, flat, marshy, and studded with lakes. Memphis, the largest city, is built on a bluff overlooking the Mississippi in the southwest (*see* Memphis).

Tennessee has about 1,200 miles of navigable streams, which have been important factors in the development of the state, long providing the chief means of transportation. The Mississippi, the Tennessee, and the Cumberland rivers (the two latter tributaries to the Ohio) form the chief drainage basins. The Tennessee, formed by the junction of the Holston and French Broad rivers, near Knoxville, crosses the state twice in the 800 miles of its course. Flowing southwestward to Chattanooga, it swings around in a broad curve through northern Alabama, reënters Tennessee and flows north to the Ohio, which it joins at Paducah, Ky. The river derives its name from the Indian words for "big bend," and the state is often called the "Big Bend State" after the river and its great loop. The Tennessee is navigable for light-draft vessels, and iron ore, cotton, live stock, and lumber are transported by this route, canals having been constructed around the dams at Hale's Bar and at Muscle Shoals, at Florence, Ala.

The Cumberland River, rising in the Cumberland Mountains in southeastern Kentucky, follows a U-shaped course in the northern part of the state and flows back into Kentucky, entering the Ohio River not far from the Tennessee, 688 miles from its source. Along this river is some of the most beautiful scenery in America. On its way down from the highlands it forms Cumberland Falls, with a vertical drop of about 66 feet; and a few miles farther on it rushes through a gorge whose walls rise 300 feet or more. A series of government locks and dams make the river navigable the entire year from Nashville to its mouth, a distance of 193 miles. Several large water-power plants are now in operation, and much more power awaits development on the many streams and rivers of the state.

Tennessee is first of all an agricultural state, only 20 per cent of its population being urban. About four-

With its fertile river bottoms, its rich store of minerals in the highlands, its forests, and its abundance of water power, Tennessee is one of the most favored of the states as to variety of resources. Corn is the chief crop, followed by wheat and cotton. Coal is the most abundant mineral. The University of Tennessee was founded in 1794 as Blount College.

contained in the Easy Reference Fact-Index at the end of this work

A BIRD'S-EYE VIEW OF THE "BIG BEND" STATE

The three main divisions of Tennessee may easily be traced on this relief map—Western Tennessee, from the Mississippi to the Tennessee River; Middle Tennessee, to the sharply rising Cumberland Plateau; and mountainous Eastern Tennessee.

fifths of its area is suitable for farming and about one-half of this improved. Almost every crop listed in the Federal census is grown to some extent, but corn, cotton, and wheat are the great staple crops. Large quantities of clover, timothy, soy beans, cowpeas, vetch, and alfalfa are grown for hay. All the fruits and vegetables of the temperate zone thrive in almost every part of the state, and Tennessee strawberries and tomatoes begin to arrive in the Northern markets long before the snow is off the ground. In recent years commercial orcharding and gardening have developed rapidly, and stock-raising is gaining in importance.

Tennessee's Rich Mineral Resources

Coal, mined extensively on the Cumberland Plateau, is the most valuable of the state's rich mineral resources. More copper is mined in the southeastern part of the state than in all the other states east of the Mississippi, except Michigan. These mines were the chief source of supply for the Confederate States during the Civil War. Zinc, in the east, and iron, in the east and central parts, are also important. The western portion of the state produces an excellent quality of ball clay, and the quarries of eastern Tennessee have long been famous for building marble, which the state produces in greater quantities than any other state except Vermont and Georgia. In the production of phosphate rock Tennessee is one of the leading states. Brick and tile clay and limestone are scattered through many counties of the state. There are also deposits of several other minerals. Gold and silver have been mined, but not in large quantities. As one of the state geologists has said, "With her abundant and varied mineral resources, Tennessee, if cut off from communication with all other states, could continue to supply herself with all, or nearly all, of the needful materials to maintain her present or future civilization. Water-power and coal would supply her with power; her iron, lead, zinc, copper, gold, silver, aluminum, and other mines would supply her with metals; her building stones, marbles, clays, cement materials, and forests would supply her with building materials; most of the materials used in chemistry and the arts she could secure from her own storehouse if cut off from outside supplies, and with the exception of tropical fruits, she could raise any food that is raised anywhere in the United States of America."

How the chief religious denominations of the state compare.

More than half of the state is timber land, and lumber and timber products are the chief manufactures. Flour milling, iron and steel manufactures, the making of hosiery and knit goods, and cotton-seed milling are other important industries. Cheap water-power and great natural resources give promise that in years to come Tennessee will be a great manufacturing state.

The University of Tennessee, in Knoxville, is the head of the state system of education. The East Tennessee Normal School is at Johnson City, the Middle Tennessee Normal School at Murfreesboro, and the West Tennessee Normal School at Memphis. The George Peabody College for teachers and the Agricultural and Industrial Normal School (for negroes) are at Nashville. Among other important educational institutions are the University of Chattanooga at Chattanooga, Vanderbilt University at Nashville, the University of the South at Sewanee, and Fisk University (for negroes) at Nashville.

Tennessee in American History

Probably De Soto was the first white man to enter the Tennessee region (1541). In 1682 La Salle built Fort Prud'homme where Memphis now stands. Fort Loudon was built by the English in 1756, about 30 miles north of the site of Knoxville, as an outpost against the French. Four years later the garrison and settlers were massacred by the Cherokee Indians. The first permanent settlements were made in 1769 by

North Carolinians and Virginians. Although these settlements were within what were then the limits of North Carolina, they were without protection or government; and so the pioneers, under the leadership of John Sevier and James Robertson, established a form of government since known as the Watauga Association. These were the first white men of America, says Theodore Roosevelt, to establish a free and independent community on the continent.

Service in the Revolution

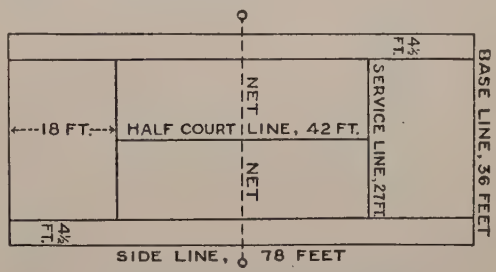
With the Revolutionary War, the inhabitants petitioned for annexation to the colony of North Carolina. The petition was granted and in 1777 the territory became Washington County, with the Mississippi marking its western boundary. The hardy mountain riflemen, under Colonel Sevier, did valiant service in South Carolina during the Revolution. After the war, North Carolina offered to cede the whole Tennessee region to the Federal government. Outraged at this attempt to transfer them without their consent, the settlers organized a new state, which they called "the State of Franklin" (at first "Frankland"). Sevier was elected governor. Neither North Carolina nor Congress could be induced to recognize the independence of Franklin, and in 1788 the governor of North Carolina arrested Sevier on a charge of treason, but allowed him to escape (*see* Sevier, John). Two years later North Carolina again ceded the territory to the Federal government, and the transfer was accepted. After six years of territorial government, Tennessee was admitted to the Union (1796) as the 16th state, and Sevier, who was for many years the most prominent figure in the state, was elected the first governor.

In the Mexican War Tennessee won the nickname of the "Volunteer State," because 30,000 men immediately enlisted when the governor called for 2,800 troops. Throughout the troubled times preceding the Civil War, Tennessee was opposed to secession; but with Lincoln's call for troops the legislature submitted the question directly to the people, who voted overwhelmingly to join the Confederacy. But under the lead of Senator (later vice-president and president) Andrew Johnson, the eastern and some of the central counties organized a Union government. These counties have since been strongly Republican in an otherwise Democratic state.

Tennessee was the scene of more battles in the Civil War than any other state except Virginia, more than 400 battles and skirmishes being fought on its soil. The state gave 115,000 soldiers to the Confederate army, and from eastern Tennessee came 31,000 to join the Union armies.

Tennessee was the first of the Southern states to be readmitted to the Union (July 24, 1866). While the state had the good fortune to escape the rule of the "carpet-baggers," the vote was confined to those whites who had been loyal to the Union, and to the negroes. The famous Ku Klux Klan was organized at Pulaski, Tenn., in 1865, with the avowed object of maintaining the supremacy of the white race. In common with other Southern states, Tennessee experienced a period of stagnation following the Civil War, but since 1880 it has made rapid and continuous progress, especially in mining and manufacturing.

TENNIS. Lawn tennis is a modern development of an older game of tennis played in a covered court. The present game was first played in England about 1873, and soon after was introduced in the United States. It has increased rapidly in popularity and has gradually, through various changes in the rules, reached its present form. The right of tennis to be called the most popular and cosmopolitan game in the world seems clear, for it is played in virtually every country under the same rules, and the number of persons who play the game grows larger each year. It is one of the few games in which almost as many girls and women take part as boys and men.



This shows the standard plan and dimensions of a tennis court for both "singles" and "doubles" play.

The tennis court is marked out on a closely cut, level grass lawn, or on hard earth, clay, or concrete; it is 78 feet long and 27 feet wide. When four persons play the game the court is 9 feet wider, the extra width being taken up by two side courts, each $4\frac{1}{2}$ feet wide. It is divided in halves by a net 3 feet high in the center, and 3 feet 6 inches at the posts which support the ends. White lines or tapes indicate the base lines, side lines, service lines, and half court line within the court.

What the Game is All About

The object of the game is for the player on one side of the net to send the ball into his opponent's court in such a manner that it cannot be returned. The ball is a hollow sphere of rubber covered with white felt, $2\frac{1}{2}$ inches in diameter. The racket is a flat net of tightly strung gut in a frame, with a handle a little more than a foot long; the whole is about 27 inches in length and usually weighs about 14 ounces.

At the start of a match of singles—as the game is called when two persons play—one player "serves" while the other "receives." The server stands with both feet behind the base-line, tosses the ball into the air, and by striking it with the racket sends it over the net into his opponent's service court diagonally opposite. If the first ball is a "fault" he tries with a second ball. The receiver, or "striker-out," as he is called, must hit the ball on the first bound, attempting to drive it back over the net so that it will fall

within the court. If he fails to return it over the net or sends it outside the court, he loses the point. After the service has been returned either player may hit the ball before it has bounced—"volley" it—if he wishes. The ball often passes back and forth across the net several times before one of the players fails to return it. The service alternates, first from the right, then from the left court, and a player continues to serve until he wins or loses a game, when the service passes to his opponent. The doubles game on the larger court—with two players on each side of the net—is played in the same manner, except that the partners alternate in serving.

Other Technical Terms of Tennis

The first point won makes the score 15, the second point 30, the third 40, and the fourth wins the game unless each player has scored 40. In that case the score is "deuce," and in order to win the game thereafter one player or the other must take two points in succession. The scores "15 to 0" and "30 to 0" are called as "15 love," "30 love," etc., the opposite are "love 15," and so on. The first of the two points after "deuce" is called "advantage in" if won by the server, and "advantage out" if won by the striker-out.

At the end of each game the player who has served becomes striker-out while his opponent serves. The play continues until one player wins six games, which gives him the "set." If, however, the score should become five games all, the set stands at "deuce" and one player or the other must win two consecutive games in order to win the set. Sides are changed at the end of every set. A match is either two out of three sets or three out of five.

The principal strokes that a player uses in returning the ball are the "forehand drive," the "backhand," the "volley," the "lob," and the "overhead smash." If he is a right-handed player and the ball falls to the right of his body and in front of him, he uses his forehand drive by hitting the ball with a vigorous forward swing near the top of its bounce. If the ball falls to his left, he swings the racket across his body and hits it with a back-hand stroke. Often when he can reach the ball before it bounces he "volleys" by hitting it while it is still in the air. If his opponent has run in close to the net he sometimes "lobs" by sending the ball over the opponent's head. The overhead smash is used in "killing off" any weak returns that his opponent may send high above the net.

The Art of Serving

Service gives opportunity for many skilful strokes. Within recent years a most effective service has been developed in the United States, known as the "American twist" service. By tossing the ball directly overhead and by hitting it in such a way as to give it a spinning motion, it is sent across the net on a right to left curve, "breaking back" on the bound from left to right on striking the ground. It is extremely difficult for the striker-out to hit this service squarely.

There are many "fine points" in lawn tennis and much opportunity for the study of technique. Quickness of mind, eye, and limb are essential—and endurance too, for a fast match between skilful opponents calls for the strenuous exercise of virtually every muscle in the body.

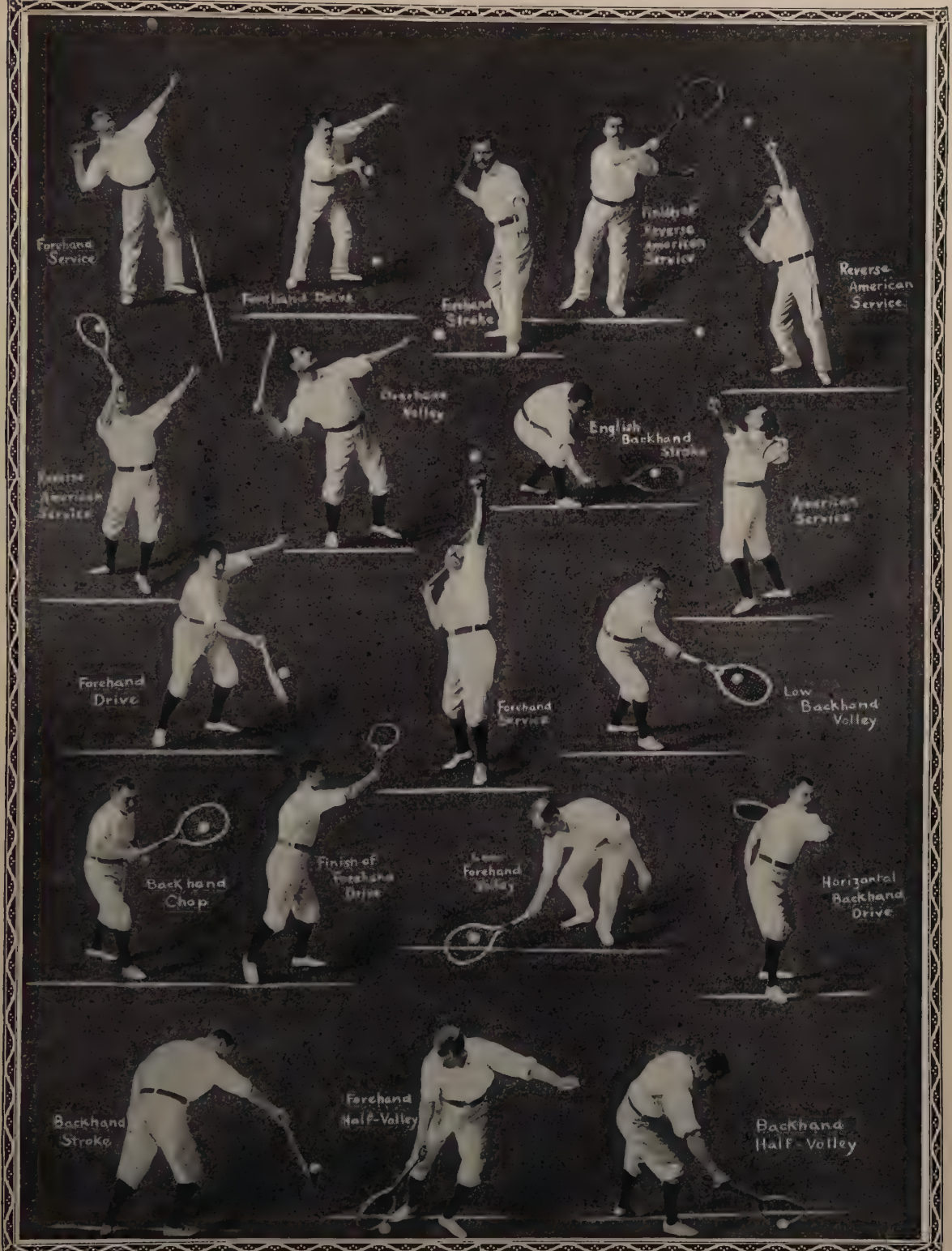
Court tennis, the father of lawn tennis, is one of the oldest of ball games and one of the most difficult to learn. It is played in a walled and roofed court. Around the two end walls and one side wall runs a corridor with a downward-sloping roof, called the "penthouse." The net across the middle divides the court into the "service" side and the "hazard" side. In the end wall on the service side under the penthouse is an opening for spectators, called the "dedans," protected by a net. The wall to the right of the service side is clear except for a buttress called the "tambour." The racquets used are strong and heavy with a bulging side, and the interior of the ball is of cloth. The play is too complicated to be explained in detail. In general, the ball, struck from the service court, must go over the net, hit the side penthouse roof or the wall above it, and must rebound into the service court of the hazard side; otherwise it is a pass or a foul. The score is counted as in lawn tennis.

TENNYSON, ALFRED (1809–1892). No other English poet, during his own lifetime, has held England under such unbroken sway as this master minstrel of the Victorian Age. Born in the rectory of Somersby, Lincolnshire, son of the Rev. Charles Tennyson, he began to write verse in childhood. At 18 he and his brother Charles published a small book of poetry, and at 20, while at Trinity College (Cambridge) he took the Chancellor's prize with 'Timbuctoo' written in unrhymed verse. A volume of poems issued at the age of 24, contained such exquisite things as 'The Lotus Eater', 'The Lady of Shalott', and 'The Dream of Fair Women'. Tennyson's work thus early displayed happy phrasing, finished art, and sentiment fresh, pure, and deep. Soon after, when he lost his closest friend, Arthur Hallam, by death, he turned in sorrow to the theme of life and death. But the depth of his grief and his spiritual consolation were not revealed until 17 years later with the publication of 'In Memoriam'. "This noble elegy, the most illustrious single poem of the 19th century," says Henry van Dyke, "is the English classic on the love of immortality and the immortality of love."

When 'In Memoriam' appeared in 1850, Tennyson had already won his place as the first poet of England. Meanwhile the sale of his poems had gradually increased to such a point that it was safe for him to settle down, and on June 13, 1850, he was married to Emily Sellwood, the young woman who had waited for him through ten years of poverty. Of this happy marriage it is enough to record Tennyson's own words, written many years later: "The peace of God came into my life before the altar when I wedded her."

It now appeared as if every kind of good fortune were about to descend on the man who had struggled for years against every kind of bad luck. Less than six months after his marriage he was appointed poet

THE CHIEF "STROKES" IN TENNIS



These photographs indicate the proper positions of body, legs, arms, and hands in making the various standard tennis strokes. The forehand service, which is the most commonly used, gives the ball "top-spin," causing it to bounce high and fast. The reverse American service puts a side "cut" on the ball causing it to "break" as it bounds. The usual forehand drive is executed with a forward and upward movement of the racket, giving "top-spin" which makes the ball shoot downward after it clears the net. The "chop" strokes, on the other hand produce "back-spin," which tends to make the ball sail and to skid as it strikes the court.

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laureate, succeeding Wordsworth. In 1854 he wrote his popular poem, 'The Charge of the Light Brigade', and in 1859 appeared the first volume of the 'Idylls of the King', which won a popular success greater than was ever achieved by any other English poet with the possible exception of Scott and Byron. Then followed more than 30 years of increasing fame and wealth, culminating in the honor of being raised to the British peerage in 1884 as Baron Tennyson.

It is difficult to characterize the style and estimate the value of a poet who wrote so much and on such different themes over a period of 60 years, but certain qualities may be noted. All of his work was marked by melody, as of music heard in the blue mystery of twilight, the tender haze of dawn, or the glory of sunset; for no less marked was the intimate feeling for the beauties of land and sea which invests his verse with an atmosphere of delicate enchantment. All of rural England is in such lines as

> —gray twilight pour'd
> On dewy pastures, dewy trees,
> Softer than sleep—all things in order stored,
> A haunt of ancient peace.

He had an imaginative sympathy with human nature; a reverence for order and tradition; and he was so profoundly spiritual that he has been called "the poet of the endless life." In poetic romances of the highest ethical worth he clothed King Arthur and his knights with new dignity and splendor. The public was enchanted with the purity, sweetness, noble sentiments, and pageantry of the 'Idylls of the King', and as they appeared a few at a time, over a period of many years, they were waited for and received with an acclaim unparalleled in English poetry.

These 12 narrative poems are unified through the personality of the hero, Arthur, the ideal king. (*See* Arthur, King.) Beginning with 'The Coming of Arthur', the poet traces the establishment of the Order of the Round Table and the building up of the kingdom, various events in the lives of Arthur and his knights, including the great quest for the Holy Grail, and the gradual decay of the kingdom through the sin and treachery of those whom the king had trusted. Finally, in 'The Passing of Arthur' he pictures that "last, dim, weird battle" in which Arthur receives a mortal wound and is borne away to "the island-valley of Avilion." Underlying the story a deeper allegorical meaning is suggested, that of "sense at war with soul," the struggle of the human soul as it passes through the long fierce struggle of life to death and immortality.

TENNYSON
Most Melodious of Victorian Poets

Tennyson sounded the trumpet-note of English heroism; and he stole his way into the hearts of English-speaking peoples everywhere with his matchless lyrics and narrative poems and little bursts of song that almost set themselves to music. Last of the great group of Wordsworth, Coleridge, Byron, Shelley, and Keats, Tennyson was more remarkable for beauty and lofty and tender sentiment than for the vigor and strength that marked much of the English poetry after Browning. His chief disappointment as a writer was the failure of his persistent attempts to write drama that could be acted.

Tennyson's influence on the thought, feeling, and taste of his time was both wide and profound. In later years, while living on beautiful country estates on the Isle of Wight and in Sussex, he was a figure of interest and reverent admiration. His life came to a serene, poetic end at the age of 83. Through the immense uncurtained window which framed his view of the English Channel, he looked his last on the moonlight and the sea, and had his wish for—

> Sunset and evening star
> And one clear call for me,
> And may there be no moaning of the bar
> When I put out to sea.

Tennyson's chief works are: 'Timbuctoo' (1829); 'Poems, Chiefly Lyrical' (1830); 'Poems', which include the 'Morte d'Arthur' of the 'Idylls of the King' (1842); 'The Princess, a Medley' (1847); 'In Memoriam' (1850); 'Maud' (1855); 'Four Idylls of the King' (1859); 'Enoch Arden and Other Poems' (1864); various poetic dramas from 1875 to 1884, of which 'Becket' was successful as a stage play; 'Ballads' (1880); 'Idylls of the King' at long intervals until the cycle of 12 was completed; 'Locksley Hall Sixty Years After' (1886). In the year of his death Tennyson completed the drama of 'The Foresters' (the story of Robin Hood and Maid Marian).

TEUTONS. Those peoples who speak any one of the various Teutonic languages—English, German, Dutch, Flemish, and the various Scandinavian tongues—are properly grouped together as "Teutons," though the name is at times more narrowly applied to the people of Germany, as the more numerous stock. The name "Teutonic invasions" is often applied to the wandering of Germanic peoples, from the 4th to the 9th centuries inclusive, which overturned the Roman Empire in the west and established the nations of western Europe in practically their present locations. The name Teuton was originally the name of an ancient German tribe that dwelt north of the Elbe, and first appeared in the history of Europe along with the Cimbri, about 300 B.C. (*See* Europe; Goths; Northmen; Roman History.)

The "LONE STAR" STATE

Its Storied Past and Its Busy Present

Extent.—East to west, nearly 800 miles; north to south, about 753 miles. Area, 265,896 square miles. Population (1920 census), 4,663,228.

Physical Features.—400 miles of island-fringed coast forming the southeastern boundary; land surface a series of plains sloping southeast from the plateau of the northwest (Staked Plain—*Llano Estacado*—4,000 feet) and the mountains of the west (Guadalupe Peak, about 9,000 feet). Principal rivers: Red River forming part of the northern boundary, the Sabine on the east, the Brazos, Colorado, the Rio Grande forming the southwestern boundary, and its tributary, the Pecos.

Products.—Cotton, corn, wheat, oats, hay, rice, peanuts, sorghum, fruits and vegetables; cattle, horses, mules, hogs, sheep and wool; petroleum and its products, sulphur, coal, natural gas; lumber and timber products, meat products, cottonseed oil and cake, flour and meal, railroad cars.

Chief Cities.—San Antonio (about 165,000), Dallas (160,000), Houston (140,000), Fort Worth (110,000), El Paso, Galveston, Beaumont (over 40,000), Austin (capital).

The Alamo was the cradle of Texan liberty. Within its walls perished David Crockett, James Bowie, William B. Travis, and their band of 180 Texans, when Santa Anna and 4,000 Mexicans stormed the little fort. The Alamo is now in the heart of San Antonio.

TEXAS. The "Lone Star State," as Texas is popularly called, is the only commonwealth that was an independent republic before it joined the Union; and it also has the distinction of having existed in its romantic history under six flags—that of France planted by La Salle over an ill-fated colony on the coast, the Spanish flag, the Mexican, the "lone star" banner of its independent statehood, the Stars and Stripes, and the flag of the Southern confederacy. Texas is also interesting as by far the largest of the states of the Union, and its fertile lands, its mineral resources, and its geographic position make it of very great importance. Moreover, Texas is in the midst of an amazing era of development. The tractor with its dozen plows produces wealth from land which not so long ago was a battleground between the pioneer and the Indian and the scarcely more advanced Mexican. The princely million-acre ranches of its early history are largely broken up into farms, and even the semi-arid western plains are bringing forth enormous crops, as a result of irrigation, making Texas the banner agricultural state in the Union. The discovery of its great oil fields has made the state known all over the world. Texas now ranks fifth among the states in population, and is constantly growing.

To the newcomer, the outstanding feature of Texas is its bigness. Across the state in a direct line, from Texline on the northwestern corner of the "Panhandle" to the mouth of the Rio Grande, is a greater distance than that between Chicago and New York; while from El Paso at the western tip of the state to the Sabine River on the border of Louisiana, the distance is barely a hundred miles shorter. Eight hundred miles of the Rio Grande's course goes to make up Texas' southern border, and the Gulf of Mexico washes its coast for 400 miles. A Texas editor indicates the size of the state in this way:

"If you tipped the state up and dropped it north like a tossed pancake, it would knock down the skyscrapers in St. Paul; east, and El Paso would drop into the Atlantic; south, and the State would blot out most of Mexico. If all the people in the United States were put into Texas, it would scarcely be two-thirds as crowded as England."

First of All an Agricultural State

Texas is, and probably always will be, an agricultural state first of all. Where sufficient water is obtainable, either by rainfall or by irrigation, the soil of most of the state is very fertile. The climate is mild, and the growing season extends over many months of the year. The chief crop is cotton, the state producing one-sixth of the world's supply, and ranking first among the cotton-raising states. Corn, wheat, and oats are important crops, as is also rice on the coastal prairies of southeastern Texas. Peaches, small fruits, sweet potatoes, watermelons, onions, cabbage, strawberries, and pecans are all commercially important. Texas is also first among the states in the raising of cattle, sheep, and a leader in the production of goats, horses, and mules.

The production of petroleum, which practically began with the discovery of the rich Spindle Top field in 1901, is enormous. Great new fields have been discovered, both in the older coastal oil regions and in the northern central coal district. Lumbering is also important, for about two billion feet of yellow pine are cut annually, and a lesser amount of hardwood. Manufactures are less prominent, but there are a few large meat-packing establishments, and some large oil refineries.

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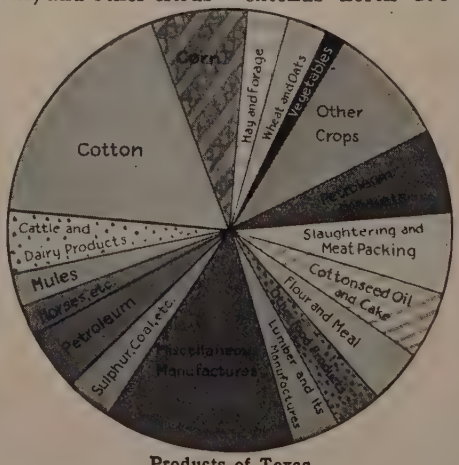
HISTORICAL AND INDUSTRIAL FEATURES OF TEXAS

This picture-map shows where some of the important events in the early history of Texas took place, also the location of the larger industrial centers and the great oil fields. Below we see the relative size of the various religious denominations.

Baptist	Methodist	Roman Catholic	Other Denominations

Considering the great area of the state, it is not surprising that there is as wide a range of climate, plant, and animal life as there is between Florida and Connecticut. In the southern coastal regions it is almost tropical, and oranges, lemons, and other citrus fruits grow luxuriantly. Up in the "Panhandle," as the northern extension of the state is called, there are often several inches of snow. A broad timber belt lies between Trinity River and the eastern state line, which is larger than any one of a dozen other states, although it comprises only a small part of the Lone Star State. Through central Texas runs a belt of black waxy soil, a fertile rolling prairie country extending between Houston and the Nueces valley to the northern part of the state; it is about 100 miles wide at the north and south, but much narrower in the middle. This region, where the great fields of cotton grow, is larger than the state of Ohio.

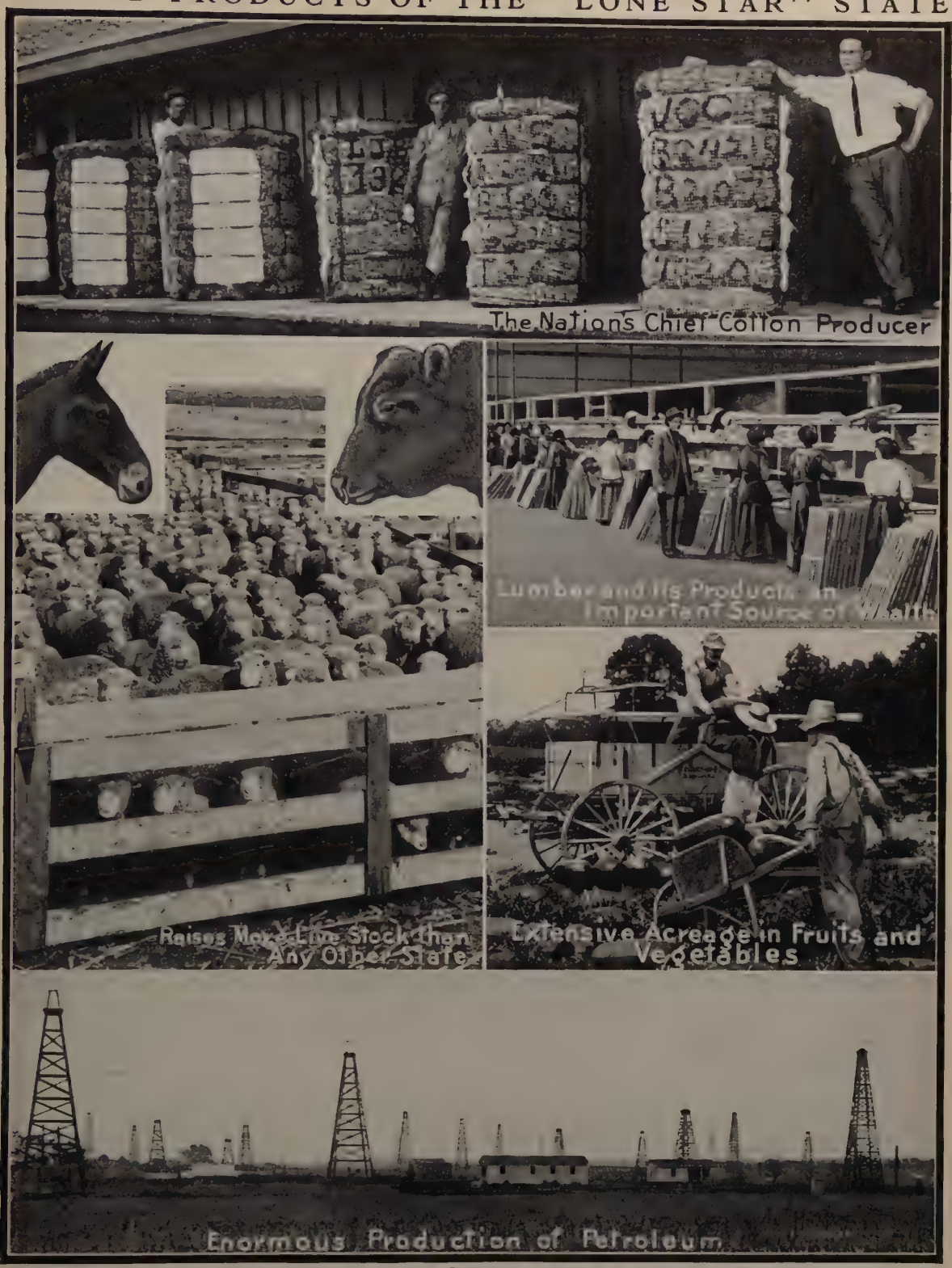


Products of Texas

At the coast, and extending over a considerable distance, is the coastal plains region where the land is little above sea-level. The waters of the Gulf deepen very slowly, and along most of the coast line lie long islands of white sand piled up by the breaking waves, inclosing shallow lagoons and bays. Padre Island extends north 100 miles from the mouth of the Rio Grande; Galveston Island and Matagorda are the next largest. Back of Padre Island is the *Laguna de Madre*, on the shores of which are large salt deposits. By dredging the shallow river channels and Gulf bed and building jetties, the harbors of Galveston and Corpus Christi bays and Sabine Lake have been opened to ocean steamers.

West of the coastal plain the rainfall gradually decreases, although the rolling plains are suitable for general farming and stock-raising. In western Texas and eastern New Mexico lies the Staked Plain (*Llano Estacado*) the eastern limit of what formerly was known as the Great American Desert. The name of this region came, it is said, from the fact that the Mission Fathers in crossing this great plateau set up stakes on which were placed

VARIED PRODUCTS OF THE "LONE STAR" STATE


The Nations Chief Cotton Producer
Raises More Live Stock than Any Other State
Extensive Acreage in Fruits and Vegetables
Enormous Production of Petroleum

Everybody knows that Texas is the largest state in the Union. It deserves an even higher reputation for being the country's greatest producer of cotton, and it also raises more live stock than any other state. In the eastern part are forests of considerable extent, and petroleum is found in large quantities, from Wichita and Clay counties on the north boundary to Beaumont County on the Gulf. All of these industries require thousands of workmen. Texas from a state of small population has risen to fifth place, being exceeded in population only by New York, Pennsylvania, Illinois, and Ohio.

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buffalo skulls, so that others could find the way. This district is only semi-arid, and the only absolute desert within the borders of the state is a limited region near El Paso. In the Panhandle section in northwestern Texas are high plateaus of from 3,000 to 4,000 feet. For a long time the Panhandle was largely a thinly settled stock country, and it is still the region of the great ranches; but in recent years settlement has been advancing rapidly, and homesteads now dot the old "range."

In southwestern Texas, beyond the Pecos River, are numerous lofty mountain ridges, interspersed with broad arid plains. Here the scenery is often very beautiful. In Brewster County a second Grand Canyon is to be found, with walls that rise almost 2,000 feet. In this region is located one of the largest quicksilver mines in the country, and lead, iron, copper, and silver are also mined in the vicinity.

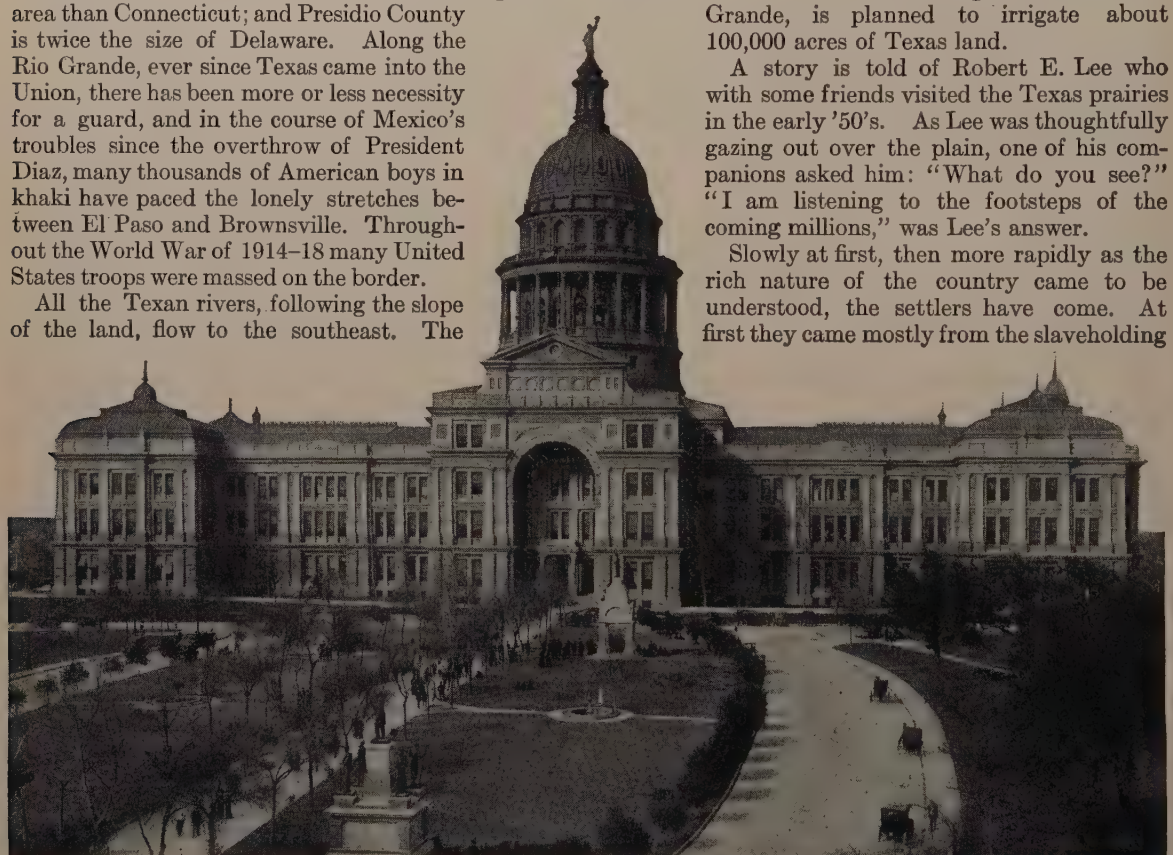
The border country, along the Rio Grande, is still wild, and is thinly populated except in irrigated areas along the river. But some of the western border counties are larger than eastern states. El Paso County before it was divided recently was larger than Massachusetts; Brewster County still has a greater area than Connecticut; and Presidio County is twice the size of Delaware. Along the Rio Grande, ever since Texas came into the Union, there has been more or less necessity for a guard, and in the course of Mexico's troubles since the overthrow of President Diaz, many thousands of American boys in khaki have paced the lonely stretches between El Paso and Brownsville. Throughout the World War of 1914–18 many United States troops were massed on the border.

All the Texan rivers, following the slope of the land, flow to the southeast. The extreme northern part of the state lies in the Mississippi basin, the Canadian River crossing the Panhandle to join the Arkansas, and the Red River forming for nearly 400 miles the northern boundary. Several rivers rising in the state flow directly into the Gulf. The principal ones are the Sabine, which forms part of the boundary between Louisiana and Texas, the Neches, Trinity, Brazos, Colorado, Guadalupe, San Antonio, and Nueces rivers. The Pecos is the greatest tributary of the Rio Grande.

In arid districts small irrigating systems were being used by the Indians when the first explorers came. There are widely scattered small systems, mostly in the western part of the state, which use water obtained from rivers, waterholes, or wells. There are also large systems, mostly along the lower courses of the rivers, which have made thousands of acres of sand productive; these are usually under one management and sell the water to the farmers. Some of the west Texas towns present a curious appearance with little windmills busily whirling away in every yard. The great United States reclamation project at Elephant Butte, N. M. (*see* map with New Mexico), with its concrete dam 300 feet high across the Rio Grande, is planned to irrigate about 100,000 acres of Texas land.

A story is told of Robert E. Lee who with some friends visited the Texas prairies in the early '50's. As Lee was thoughtfully gazing out over the plain, one of his companions asked him: "What do you see?" "I am listening to the footsteps of the coming millions," was Lee's answer.

Slowly at first, then more rapidly as the rich nature of the country came to be understood, the settlers have come. At first they came mostly from the slaveholding



The Capitol of Texas, at Austin, stands in the center of a ten-acre square, artistically laid out. It is the largest state Capitol in the United States, and is said to be one of the ten largest buildings in the world. It is in the form of a Greek cross, 556 feet long by 288 feet wide; the dome is 318 feet high and is surmounted by the figure of Liberty, holding aloft the "Lone Star" in her left hand, and a sword in her right. It required seven years (1881-1888) to complete, and an expenditure of $3,500,000. All the expenses of construction were borne by a syndicate of Chicago capitalists, who received in exchange a land grant of about 3,000,000 acres.

THE APPROACH TO THE UNIVERSITY OF TEXAS

Next to its Capitol, Austin probably prides itself most on the State University. This is the approach to the University as you come from the Capitol. At the head of University Avenue, this finely paved double boulevard, is the main building, and around it on both sides are groups of smaller buildings. The University was opened in 1883.

South; then after the Civil War settlers from the North began to arrive, and, in greatest numbers of all, men from the Middle West. The United States census of 1850—the first after the annexation—gave Texas a population of 212,000. In 20 years it had increased to more than 818,000, by 1900 to more than 2,000,000, and in 1920 this number was more than doubled. The foreign element in Texas (except Mexican) is very small, for the great majority of the settlers have come from the Middle Western states. In some of the counties, especially in the eastern part of the state, negroes are numerous; in others they are not permitted to reside. Near the border almost half the inhabitants are Mexican, while in Bowie, the extreme northeastern county, and in the adjoining Red River County, a Mexican is unknown unless he happens to be employed as a section hand by some railroad.

The Principal Cities of Texas

San Antonio, located in one of the most prosperous sections of Texas, is the largest city in the state. In the north central part are the rival neighboring cities of Dallas and Fort Worth, located about 30 miles apart, in the heart of the fertile black prairie region, and near the great oil fields. Fort Worth is an important manufacturing city and has three times the population it had only a few years ago. Dallas is the second city in the state. One-third of the population of Texas is within the area tributary to these two flourishing cities.

Houston, the first capital of the Texas republic and the metropolis of southeastern Texas, 45 miles from the Gulf, is the great cotton market. Galveston, which was of great importance before the Civil War, now has the largest and safest harbor along the Texas coast, and is the second largest seaport on the Gulf of Mexico and one of the great cotton shipping ports of the world. Its rebuilding after it was practically destroyed in 1900 by a hurricane and tidal wave was an unparalleled achievement. The thriving little town of Corpus Christi, 200 miles to the west, suffered a similar disaster in 1919.

Brownsville, named for Major Jacob Brown, whom Gen. Zachary Taylor left in charge of the fort he erected here at the mouth of the Rio Grande, in 1846, is the metropolis of the lower Rio Grande. Until recently it was still chiefly important on account of its military post. Here in 1910 was built the international bridge which connects it with the Mexican town of Matamoras. Up the river from Brownsville lies Laredo, the most important border town in south Texas, in the center of a big truck farming region.

El Paso, situated in the extreme southwestern part of the state, on the edge of a rich stretch of Rio Grande valley, is the only large city between Galveston and Los Angeles, Calif. It is located only a few miles from Isleta, or Ysleta, the oldest settlement in Texas, which was the headquarters of the Spanish government in this part of America (*see* El Paso).

The site of Austin, the capital of the state, was chosen as the capital of the Republic of Texas when it was almost at the frontier of civilization and surrounded by hostile tribes of Indians. The first capitol, a large one-story frame building, was, as late as 1846, when Texas was admitted to the United States, surrounded by a stockade for protection against Indian raids. Texas now possesses one of the finest capitol buildings in the country, which was paid for in the early days of statehood with three million acres of land in the Panhandle.

Waco, situated on the banks of the Brazos River, is a progressive city surrounded by a productive cotton country. Up in the Panhandle the chief city is

Amarillo, which in 1900 was little more than a speck on the prairie. Three great railroads meet here, so it is natural that the town has grown to be an important distributing center.

One-half the public domain was set aside for educational purposes. As this land is sold, the principal of the proceeds is invested and only the income used, thus providing for future generations. The chief educational difficulty has been the handling of the rural-school situation in thinly settled areas. There are state normal schools at Huntsville, Denton, San Marcos, Canyon City, Commerce, and Alpine for whites, and at Prairie View for negroes. The University of Texas is at Austin, with the exception of the medical school, which is at Galveston, and the school of mines at El Paso. There are also about 50 private and denominational schools, among them being Baylor University at Waco, the Southern Methodist University at Dallas, and the Rice Institute at Houston.

THE LARGEST STATE IN THE UNION

This relief map of Texas shows clearly the slope of its vast surface from northwest to southeast, with its parallel rivers running to the sea. The highest sections of the state are in the western part, beyond the Pecos River, and in the Panhandle, which is the rectangular projection at the north.

Remarkable History of the State

No state has had a more remarkable history than has Texas. The first white men to visit the country were Cabeza de Vaca, a Spaniard, and three companions, who were shipwrecked west of the Mississippi and wandered for eight years (1528–36) until they reached Mexico City. Coronado and other Spanish treasure-seekers traversed the state at times during the next 150 years, but made no effort to colonize. In fact, for nearly 200 years after its discovery the region did not have an official name and the boundaries were indefinite. The name Texas is derived from the name of a tribe or confederation of tribes of Indians, the Tejas, who dwelt on the shores of the Gulf.

The first Spanish settlement, at Ysleta, near the present El Paso, was made in 1682. La Salle's short-lived settlement for the French in 1685, near Matagorda Bay, led to the founding of Franciscan missions under the Spanish flag, some of which are still standing today. As a part of Mexico, when that country threw off the Spanish yoke in 1821, the Mexican flag was the emblem of the state for 15 years. Then Texas declared itself a republic in 1836 and for ten years had its own banner, an azure star on a white ground.

In 1821 the first party of settlers from the United States was brought by Stephen Fuller Austin to the lower Brazos River; and in 1823 San Felipe de Austin became the capital of the colony (*see* Austin, Stephen). As immigration from the United States increased, raising the population of Texas from about 4,000 in 1821 to 20,000 in 1830, friction with the Mexican government became acute; and when Santa Anna established a dictatorship over Mexico in 1835, the Texans decided on revolt.

At the Alamo

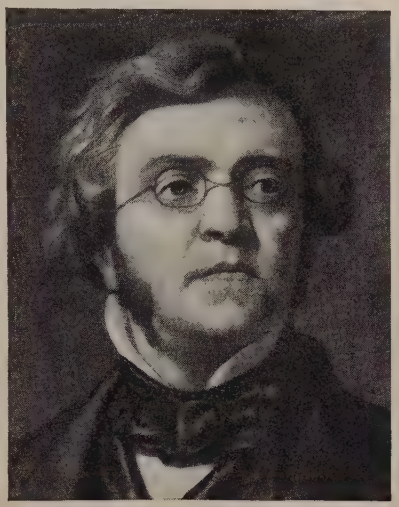
The heroic but unsuccessful defense of the Alamo was the most striking event of the Texan war for independence. Within the stone-walled yard of this Franciscan church and monastery, built in 1722 in what is now San Antonio, about 180 Texans for 11 days resisted a Mexican besieging force of nearly 4,000 men with several cannon. The Alamo fell, after a desperate hand-to-hand fight, on Sunday morning, March 6, 1836. Six people who were in the fort at the beginning of the battle were spared by the Mexicans—three women, two children, and a negro boy—but not a single soldier. Among those who were killed were the frontiersman David Crockett, and Col. James Bowie, from whom the bowie knife was named. "Remember the Alamo" then became the war-cry of the Texans. Independence was practically gained when Gen. Sam Houston (*see* Houston, Sam) defeated and captured Santa Anna at San Jacinto on April 21 of the same year.

In 1845 Texas was admitted to the United States by a joint resolution of Congress. Disputes with Mexico over the boundaries of the new state brought on the Mexican War (*see* Mexican War) which established the Rio Grande as the international boundary as far as El Paso. In 1850 Congress

purchased from Texas for the sum of $10,000,000 the claim of that state to some 100,000 square miles now included in the states of New Mexico, Colorado, Oklahoma, and Wyoming.

Under the Stars and Stripes, Texas grew rapidly. When the Civil War came, Texas as a slaveholding state seceded, thus adding the Confederate ensign to the list of its flags. During this war very little fighting was done on Texas soil, although the last battle of the war was fought near Palo Alto, on the Rio Grande, May 13, 1865.

In 1874 the Texas Rangers came into existence for the purpose of protecting the settlers from forays of Indians and white and Mexican outlaws. This semi-military organization, unlike anything in North America except the Canadian Mounted Police, has done more than any other one factor to bring peace and order to the broad prairies. For some years past, there have been only two companies of Rangers, but the force is increased at times to meet great emergencies.



THACKERAY
Keen Portrayer of English Life

No state has a stronger state pride than has Texas, and the record of its mighty achievements in carving an empire out of the wilderness vitalizes the spirit of every Texan. Every child is taught the history of his state, so that the tradition of Texas becomes a part of his daily life and thought. The college song of the state university, which is located at Austin, has for its refrain, "The eyes of Texas are upon you." This song has spread beyond the campus, and on the battlefields of France thousands of young Texans in the World War went "over the top" singing it, some to fall with the words of the refrain still on their lips.

Thackeray, William Makepeace (1811–1863). Of all the great English novelists of the 19th century, there is none who gives us so strong a sense of real people living in a real world as does Thackeray. George Eliot shows us what people think. Dickens is apt to reduce them to a few exaggerated characteristics. But Thackeray gives us men and women in action, against a background of English society—loving, hating, pretending, gossiping, sinning and suffering. As someone has said, we know Thackeray's characters as we know our friends and neighbors.

There is no doubt that Thackeray loved his characters. One day he came from his study sobbing, and said, "I have killed Colonel Newcome." And yet in 'Vanity Fair', which he considered his greatest novel, he pretended to think of the persons in the book as puppets at a fair. He says: "The famous little *Becky* puppet has been pronounced to be uncommonly flexible in the joints and lively on the wire; the *Amelia* doll, though it has a smaller circle of admirers, has yet been carved and dressed with the greatest care by the artist."

In spite of his biting comments and explanatory remarks, which, like the showman at a fair, he scatters through this book, one feels his human sympathy and kindness. He is just as sorry for the wicked little Becky Sharp and the helpless Amelia as we are.

Thackeray knew how to create real people. More than that, he puts them into a real world—the world of fashionable English society of the 18th and 19th centuries. His education at Cambridge University, his travels about Europe, his experience as a fashionable young man, gave him familiarity and ease in dealing with the jostling figures of 'Vanity Fair'. He knew real gentlemen—'Henry Esmond' and 'The Newcomes' could never have been written otherwise.

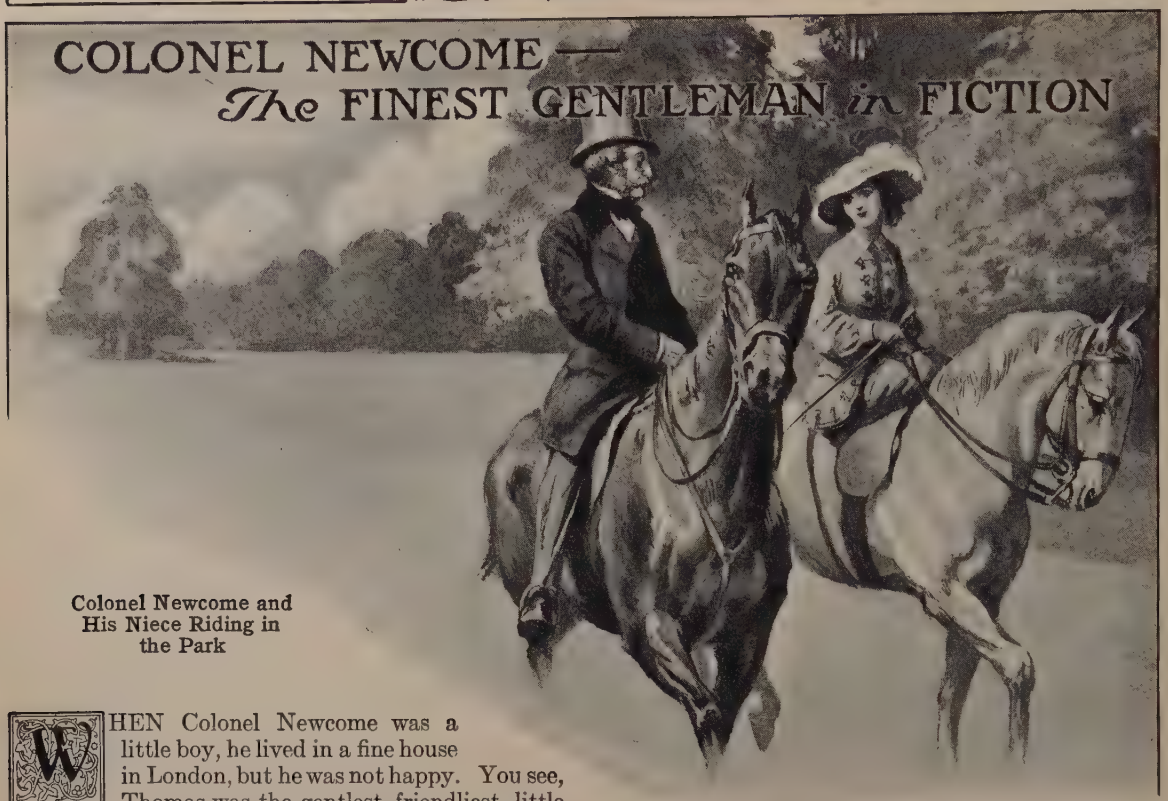
'Vanity Fair' alone is enough to bring Thackeray fame. 'Henry Esmond'—a tale of the days of James Stuart, the Old Pretender to the British throne—gives him the claim of being a very great artist indeed. Thackeray puts the story into the hand of the chief character of the book and never for an instant steps into it himself. Thackeray shifts the scene of his stories back and forth from the 17th to the early 18th centuries. To do this he had to know these periods thoroughly. He had to know the politics, the language, the literary men, the gossip of the London streets and court. The plot of 'Vanity Fair' is loose, but that of 'Henry Esmond' is considered the most perfect in any language. Besides all these perfections, there is the charm of character. Henry Esmond as the hero, although he tells the story himself, modestly and quietly, yet contrives to impress the reader as chivalrous, brave, self-sacrificing. Nor is anyone likely to forget lovely Lady Castlewood and her false, flighty, imperious daughter Beatrix, who was fascinating but not lovable.

Many people have the idea that only mature men and women can read this great English novelist with pleasure. It is true that enjoyment of his works increases with every year of age, but his style is so simple that high-school boys and girls can understand him; and if they will begin by reading 'Henry Esmond' or 'The Newcomes', they will find themselves in sympathy with his theme and point of view.

Thackeray's principal novels were: 'Vanity Fair' (1846–8); 'Pendennis' (1850); 'Henry Esmond' (1852); 'The Newcomes' (1855); 'The Virginians' (1859); Besides these he wrote several satirical works, such as 'The Snob Papers' and 'Jeames' Diary' (published in *Punch*). He also wrote a number of graceful poems, some, such as 'The Chronicle of the Drum', showing power and deep feeling.

contained in the Easy Reference Fact-Index at the end of this work

COLONEL NEWCOME — The FINEST GENTLEMAN in FICTION



Colonel Newcome and His Niece Riding in the Park

WHEN Colonel Newcome was a little boy, he lived in a fine house in London, but he was not happy. You see, Thomas was the gentlest, friendliest, little fellow in the world, yet he was lonely. His mother was dead, and his father was too busy getting rich to pay any attention to him. His stepmother was kind to him at first, then she quarreled with him; and his two half-brothers did not care for him at all. When he grew up he went to a military school and was trained to be an officer in the British Army. Very soon he sailed away with his regiment to India. That is an English colony far across the sea.

In that big, hot land of elephants and tigers and millions of strange people, young Lieutenant Thomas Newcome was happy. He had so many friends. His men and his brother officers all loved and trusted him because he was honest, unselfish, and kind-hearted. And because he was such a fine, brave soldier, he was made a captain, then a major, and finally a colonel. After his father died he felt that he had no family or home in England. Then he married an English lady, and when his little boy, Clive, was born, he felt like a prince in a fairy tale. He had a home, at last, and a wife and little son to love and care for. He meant to live in India and be happy ever after.

But trouble came. His wife died, and Clive just "pined away," as dear old grandmothers used to say. He wasn't really sick, but he was pale and thin, and not strong enough to run and play. He liked best of all to lie in a hammock and hold his father's hand.

Now Colonel Newcome knew what was the matter before the doctors told him. The hot, damp climate of India is not good for English children. If Clive was to grow up well and strong he must be sent to England. It almost broke his heart to part with his darling little boy. But he was a brave soldier, so he put Clive on a ship and sent him to the Greyfriars School for boys in London. In that school he had spent the happiest days of his own boyhood, and he knew that the masters and teachers would be kind to his son.

Colonel Newcome was very lonely when Clive was gone. Every month he wrote a long, loving letter to the little boy, and he treasured the letters and reports that came back. He had the finest dreams and plans for Clive. Some day they would travel together and see strange countries. He read books and studied maps, and he dressed shabbily so he could save money. He told his friends how well and strong and happy Clive was at school. The lad was not lonely, for he was a great favorite, and his schoolmates invited him to their homes for vacations. He read Clive's letters to his friends, and showed his clever drawings with pride. Clive was to be an artist and study in Rome.

At last, after nine long years, Colonel Newcome got a furlough to visit his son in London. It was the play hour when he arrived at the school, but Clive was at the gate waiting for him. It was a wonderful thing for a boy to have Colonel Thomas Newcome of the Bengal Cavalry for a father, and come all the way from India to see him. So the little boys crowded around, the big boys looked down from the dormitory windows, and the masters came from their stroll in the garden to see their old pupil.

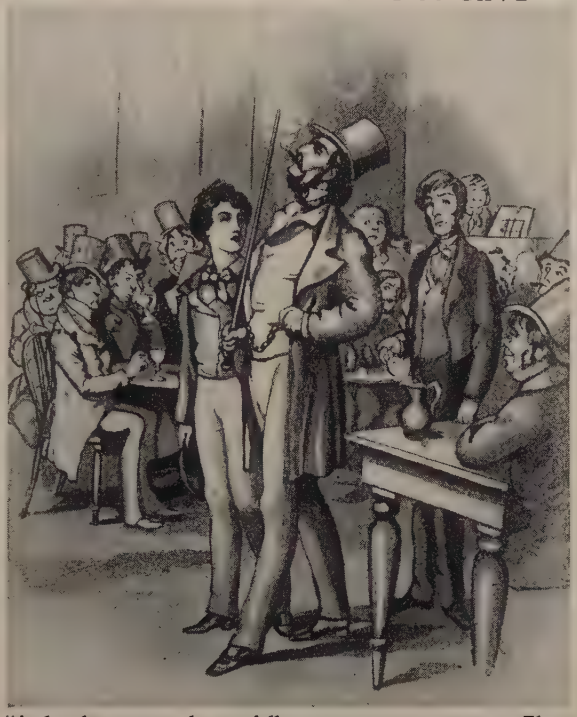
For any subject not found in its alphabetical place see information

And there he was, shabbily dressed, but a very straight, soldierly gentleman, with a lean brown face and black mustaches. With the kindest smile and finest manners, he greeted them all. Then he tucked Clive's hand in his arm and marched him away to the house which he and his friend, James Binnie, had rented.

"Isn't my lad a fine fellow, James?" His face fairly shone with joy and pride. "My Clive grown up so healthy and handsome, and unspoiled too!"

And indeed Clive was a fine fellow, with his light wavy hair, laughing mouth, and blue eyes so full of good humor and good sense. And he was as honest, frank, and modest as his father. The two of them were the best of friends at once, and their pleasure in each other's society is a beautiful thing to read about. The Colonel went everywhere with Clive, met his friends, learned his tastes and habits, and corrected his faults of character. Once, after seeing a play, he went to supper with Clive in "The Cave," a restaurant where some of Clive's student-friends were gathered.

COLONEL NEWCOME IN "THE CAVE"



"A drunken, quarrelsome fellow sang a coarse song. Then the clean-minded gentleman rose to his feet and rebuked the landlord for allowing such behavior and took Clive home."

Never had those young men seen such manners as Colonel Newcome's. He was so kind and friendly and simple that he put them all at their ease. When he told of his own school days his voice was soft and pleasant. He enjoyed the harmless rough play and the rollicking songs, and sang an old ballad himself in the best style.

How Colonel Newcome Rebuked the Rowdy

The evening went well until a drunken, quarrelsome fellow sang a coarse song. Then the brave soldier and clean-minded gentleman rose to his feet and rebuked the landlord for allowing such behavior. Simply and firmly he spoke his mind about the duty of elders to protect the manners and morals of the young. Then he took Clive home. In the morning he talked with his son of the dangers of loose habits, low tastes, and evil, untrustworthy companions.

"The truest honor," he said, "is the manly confession of wrong, and the highest courage the courage to avoid temptation."

When his furlough came to an end, Colonel Newcome went back to India. To make the money that Clive needed for his art studies, he put all his small fortune into a banking business. It was managed by dishonest men, but the Colonel did not know that, and he was so happy when they began to make money very fast. In a few years he was a director of the bank and had a large income. So he resigned from the army and came home to represent the bank in London. He traveled with Clive; and when Clive married he bought a fine house in London, and they all lived there together. Then the banking company failed. The dishonest managers ran away with all the money, and left Colonel Newcome ruined and dishonored.

The Sad End

There were some dreadful scenes. Many of Colonel Newcome's friends, trusting him, had put their money in his bank, and lost their all. Clive's mother-in-law abused him, and Clive's young wife became ill. The Colonel was seventy years old when all these misfortunes came upon him, but he bore them like a gallant soldier and a brave, tender, unselfish gentleman. In order that he might not add to Clive's troubles, he found refuge as a pensioner of his old school of Greyfriars, which used part of its funds to support a few poverty-stricken old men.

There he wore the black gown of a pensioner. Although living on charity, broken-hearted, and failing in mind and body, he kept his pride and his sweetness of spirit. He had been too innocent and trustful, and had been used by bad men; but he had done no wrong, and so he could bear his undeserved disgrace with noble patience. He had the great joy of living to see happier days dawning for Clive.

When he lay in his last illness, and Clive brought his little grandson to see him, his kind old eyes lighted up with happiness, and with eager, trembling fingers, he sought under the bedclothes and in the pockets of his dressing gown for the toys or cakes he had ready for the child.

At the usual hour the chapel bell began to toll. As the last bell struck, a sweet smile shone over his face. He lifted his head a little and quickly said, "Adsum!"—the Latin word used at school in answer to the roll-call—and fell back. And lo! he whose heart was that of a little child stood in the presence of The Master.

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THAMES (*tĕmz*) **RIVER.** The largest river of England, the Thames is also the most important, having as large a traffic, probably, as any river in the world. It rises in the Cotswold Hills in southwestern England, and flows in an easterly direction to the North Sea. It is about 210 miles long, and as far as London, 47 miles from its mouth, is navigable for large vessels. It is 18 miles wide at the mouth, and the tide flows up for 72 miles. Its bridges and tunnels at London, its great docks and embankments, are a part of the sights of the city. Canals connect the Thames with the Avon and the Severn, with the Sussex coast, and with the canal system of central England. From London to Oxford it is much used by rowboats, launches, and houseboats, and on any Saturday, Sunday or holiday in summer, it is sure to present a gay and festive scene. The Thames has played an important part in the history of the islands since before the invasion of Julius Caesar.

THANKSGIVING. With Indians as guests of honor, about tables loaded with game and fish, wild fruits from the forest, and corn-bread and vegetables from their new gardens, the Pilgrim Fathers celebrated their first American harvest festival, in October 1621, the first autumn of the exiles in their new home.

A quaint old account thus describes the occasion: "Our harvest being gotten in, our Governour sent foure men on fowling, so that we might after a more special manner rejoyce together after we had gathered the fruit of our labours. They foure in one day killed as much fowle as, with a little help beside, served the Company almost a weeke." Many of the Indians, among them Chief Massasoit, the Pilgrims' friend and ally, joined in the three days' feasting. There was plenty of roast turkey, for the fowlers found "great store" of the now famous Thanksgiving bird in the neighborhood of Plymouth. But in this old account there is no record to show that this was a day set apart for giving thanks.

The year following the harvest festival was filled with misfortune and the colonists had held no autumn feast. With empty larders they were counting the days until the spring-sown crops should furnish them with supplies. Then a terrible drouth withered the corn in the fields and burned the gardens brown. A day of special prayer was followed by a long refreshing rain, and at the same time a ship loaded with friends and supplies was sighted. So the governor appointed a day for "public thanksgiving." But this also was different from the present Thanksgiving Day, for we find no account that tells of feasting following the long church service.

Although we read of feasts, of fasts, and of "thanksgiving days" being observed during each year, it is not until ten years later (1636) that we find record of a celebration such as we now keep. Then we read that the colonists of Scituate, in Plymouth Colony, gathered "in the meetinghouse beginning some halfe an hour before nine and continued untill after twelve aclocke," with psalm-singing, prayer, and sermon. Then came "makeing merry to the creatures, the poorer sort beeing invited of the richer."

In the course of the Revolutionary War, the Continental Congress appointed Dec. 18, 1777, to be observed generally as a "thanksgiving day" in consequence of the surrender of Burgoyne. In the first year of his office, President Washington issued a proclamation recommending that Nov. 26, 1789, be kept as a day of "national thanksgiving" for the establishment of a form of government that made for safety and happiness.

For years the festival was almost exclusively a New England institution, celebrated by religious services in the churches, the sermon being often a political address, and by the gathering at the old home of the scattered members of the family. The day gradually became a custom in the Western and some of the Southern states, each appointing its own day. In 1864 President Lincoln issued a proclamation in which he "appointed and set aside" the last Thursday in November as a day of national thanksgiving "for the defense against unfriendly designs without and signal victories over the enemy who is of our own household."

Since Lincoln's time, each president has set aside the last Thursday of November for a like festival, so that Thanksgiving Day is now as firmly fixed a national festival as the Fourth of July itself. The proclamation of the president is usually followed by one issued by the governor of each state. The president's proclamation makes the day a legal holiday in the District of Columbia and in the territories. The religious significance of the occasion is now largely overshadowed by the feasting and "makeing merry to the creatures" which began with the old Pilgrims.

Although Thanksgiving Day is wholly an American institution, harvest festivals have been known since time immemorial. It was long customary in England and elsewhere to hold special days of "fasting and prayer" in times of peril and disaster and equally to celebrate with "thanksgiving" and feasting Nature's annual bounty and other marks of God's favor.

THEATER. In the shadow of the Acropolis, the citadel of Athens, are the ruins of the great theater of Dionysus, in which were presented the plays of the "Golden Age" of Greece. (*See* Drama.) As these great dramas remain for us one of the loftiest expressions of human genius, so the nobly proportioned Greek theater is one of the most impressive memorials of ancient architecture.

The seats of the Athenian theater, which was completed about 340 B.C., were built into the side of a hill. Thus all the spectators on the rising slope had a clear view of the "orchestra," the circle where, in the beginning, Dionysus was worshiped with choric dances. Cutting across the rear third of the orchestra was a platform about ten feet high, which in time became the stage. Across the rear of the stage extended the decorated front of the stage buildings, which took the place of a back drop and provided dressing rooms behind it for the actors.

BEHIND THE SCENES IN A GREAT THEATER

This is a sectional view of the stage of a modern theater during the performance of a spectacular piece. The audience in front gets the effect of all this machinery, without understanding just how it is produced. 1 and 2. Electric "lifts" or elevators holding parts of the scenery and some of the actors at the rear of the stage. 3. A similar lift, operated by hydraulic power. 4. A hydraulic lift which can be manipulated to give a rocking effect, as of a ship at sea. 5. A hand-worked lift. 6. A series of hand-worked lifts, to raise single performers to the stage level. Below, at the left, is a view of the "wings," showing the method of lighting to avoid all shadows. At the right we see how the flat scenes or "drops" are raised and lowered.

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It is interesting to note that the words used by the Greeks for the principal divisions of the theater are the same words that we use in English, slightly modified through the centuries. "Orchestra" is the Greek word meaning "dancing place," and is still used to designate the part of the theater immediately in front of the stage. The word "scenery" comes from the Greek word *skene*, used to designate the stage buildings, which served the Greeks as scenery. "Proscenium," applied to the part of the modern stage in front of the curtain, is identical with the Greek word *proskenion*, which designated the stage-front.

The theaters of the Greeks were all roofless and the performances were given by daylight, hence there was no need for artificial lighting. Changes of scene were very rare and only the most rudimentary stage machinery was employed, such as a "thunder-machine" and a crane for suspending in mid-air the actors who represented gods. In order that the voices of the actors might be heard in all parts of the vast theater, they wore masks equipped with a sort of megaphone. In tragedy those who represented the great legendary characters wore in addition a shoe or "buskin" with stiltlike soles to increase their height.

The theaters of the Romans were copied from the Greek structures, with certain variations and improvements. By the use of supporting arches they were able to build great sloping theaters, instead of using hillsides as the Greeks did. Since the chorus disappeared from most of their plays, the orchestra was no longer needed for the performance, and senators and other persons of note were seated here. At the same time the stage was lowered and enlarged, so as to accommodate more players. Decorations were often very lavish. Gold, marbles, fine textiles, and a system of cooling the interior of the building by means of aqueducts made the Roman theater a luxurious place of recreation.

Vast Theaters of Olden Times

For special performances temporary theaters were often built on an astonishingly extravagant scale. One such theater is said to have held 80,000 people, and to have had 360 pillars and 3,000 statues. The chariot races, gladiatorial fights, and combats with wild animals took place in such structures as the Circus Maximus of Rome, and the amphitheaters (like the Colosseum at Rome) which sprang up all over the Roman Empire.

All the grandeur of Roman theaters and amphitheaters was destined to be buried and forgotten for hundreds of years. As dramatic art grew more corrupt and debased and the circus grew more brutal, the power of the rising church was exerted against it, until finally all theatrical and kindred performances were forbidden. In the course of the Middle Ages the arenas and the amphitheaters scattered throughout the Roman world were filled with buildings used for shops and houses.

During the Middle Ages there were no theaters in the proper sense. Open-air performances were given in churchyards, in booths, or in two-storied wagons called pageants. Jugglers and mountebanks performed in the public squares and after some time strolling bands of players gave performances in courts of inns and taverns. The common people stood during the performances, but the wealthier patrons looked down from their windows and balconies.

Great Dramas in Crude Theaters

The theaters of Shakespeare's time were built in imitation of the inn-court. They were eight-sided, for the most part, with a raised stage built across one of the sides, and extending into the body of the house. Favored spectators sat on its edge or in the three-storied covered balconies that extended all the way around the building, even behind the stage. The "groundlings," as Shakespeare called the people in the "pit," stood during the performance and were unprotected from the weather. Flags were flown above the buildings as a sign that a play was on.

At the back of the stage were dressing-rooms and a curtained recess used for such scenes as the play within the play in 'Hamlet' and Desdemona's chamber in 'Othello'. The performance was always given by day, so that there was no lighting. Scenery was very simple and there was no curtain.

The public theaters during the reigns of Queen Elizabeth and James I were not patronized by women. If the court wished to see a performance, the company was "commanded" to appear in a palace hall. The form of entertainment which the higher classes preferred was the masque, which resembled the pageant of our day. These masques were given in the great halls of colleges, palaces, and other large buildings. Candles were used for lighting, seats were placed on the floor, and the balconies, if there were any, were used for guests of honor. After a while theaters were built expressly for these masques. The first one was that of the Blackfriars, where the choir boys of St. Paul's gave performances. Painted scenery was used and the entire production became very elaborate, thus foreshadowing the opera. The modern English playhouse is a direct descendant of this Blackfriars Theater, with the addition of features brought in by way of France and Italy.

The tendency throughout the 17th and 18th centuries was toward extreme elaboration. In Italy opera-houses grew more and more luxurious in scenic effects. In the 19th century such famous opera-houses as La Scala at Milan and San Carlo at Naples were built on a still greater scale. France, Germany, England, and America followed the example. Scenery and stage apparatus were enormously improved, until we get such amazingly equipped theaters as the famous Royal Opera House, Covent Garden, of London. This stage is divided into six sections which may be lifted or lowered by electrical power. Overhead is a bewildering maze of pulleys, cables, and wires controlling scenery and lighting. In some places there are revolving stages so that one-half may be used while the other half is being set.

Through the latter half of the 19th century the tendency persisted to make performances more and more spectacular; settings and costumes became still more complex and gorgeous and elaborate. A counter-tendency set in during the last decade of the century in the direction of simplification and the substitution of symbols for elaborate realistic imitations. Gordon Craig in England, Max Reinhardt in Germany, Leon Bakst in Russia, and the leaders of the Irish theater movement accomplished amazing results by the use of the simplest decorations and settings, relying chiefly for their effects on the skilful use of lighting. The work of these men has been felt in the United States in the various "Little Theaters" scattered through the country, which have followed in the steps of the pioneers of their new stage art.

HOW THE THEBANS BROKE THE POWER OF SPARTA

At the battle of Leuctra, in 371 B.C., the Theban leader Epaminondas devised a military maneuver which routed the dreaded Spartan phalanx. The Spartans as usual drew up their forces in three masses, with the strongest on the right. To oppose the right Epaminondas consolidated the bulk of his army, 50 shields deep, while his weaker center and right he withdrew slightly, so that they would not come into contact with the Spartans until after his powerful left had crushed the Spartan right. The plan worked out exactly as he had planned. The Spartans were routed, more than half of their number were slain, and the power of the Spartan state was broken forever.

THEBES (*thēbz*), GREECE. An insignificant little country town of about 5,000 inhabitants, 44 miles northwest of Athens, stands today on the spot which was once the seat of one of the oldest and greatest powers of Greece, the "seven-gated city of Thebes." Only a few ruins are to be seen today on the Cadmea, the acropolis of ancient Thebes, so called after Cadmus, the mythical founder of the city (*see* Cadmus).

Thebes lies in the central part of Boeotia in eastern Greece, a region of fertile and well-watered soil but heavy fog-laden atmosphere. The Boeotians were said by their Athenian neighbors to be as dull as their native air and their stupidity passed into a proverb. Nevertheless they produced such writers as the poet Pindar and the biographer Plutarch, and many warriors who achieved glory in battle.

Her historic past—about which grew up a group of legends scarcely less interesting than the Trojan cycle—her central location, and her strong fortifications made Thebes chief among the cities of Boeotia. As such she frequently came in conflict with Athens, and when rivalry between Athens and Sparta finally culminated in the Peloponnesian War (431–404 B.C.), Thebes sided with Sparta. After the war was ended, however, Thebes became Sparta's bitter foe, because of the arbitrary and tyrannical policies of her former ally. After numerous conflicts, the Thebans expelled the garrison which the Spartans had by treachery put in possession of the Cadmea, killed the leaders of the pro-Spartan party, and formed a combination of Greek states against Sparta. The Spartans met military reverses, and soon signed a peace with all

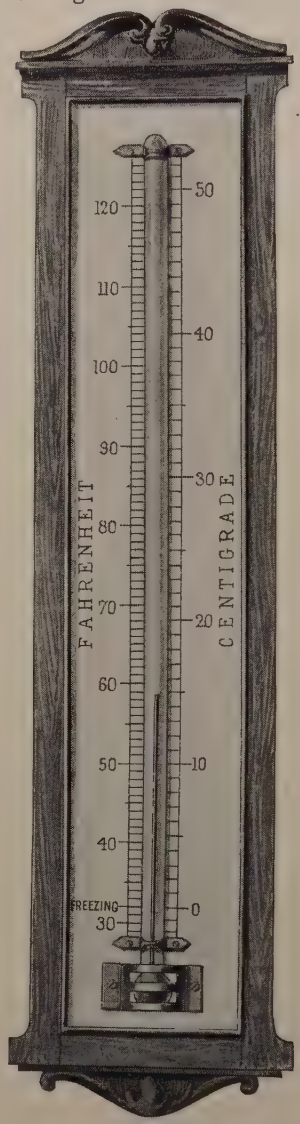
their foes except Thebes, which was left unaided to bear the onslaught of the dreaded Spartan phalanx. This tactical device consisted in drawing the heavy-armed infantry up in a solid mass eight or twelve men deep, so that the onrush flowed unbroken through the hostile lines, like a mass play in the modern game of football.

But the Theban commander Epaminondas—perhaps the noblest and most famous Greek of his day—devised an effective answer to this famous Spartan "play," which he used when he met the foe in 371 B.C. on the plain of Leuctra, about eight miles from Thebes. Epaminondas arrayed his choicest troops on the left, 50 shields deep, directly opposite the right wing of the Spartans, where they had massed as usual their heaviest force, 12 deep. His shallower and weaker center and right wings he kept drawn up so that each line was to the right and rear of the preceding one, and thus held them in reserve while the massive Theban left drove against the Spartan right and crushed it. Then the Theban center and right coming into action completed the rout. Over half the Spartans engaged were slain and Spartan power was ended.

For nine years Thebes held the supremacy of all Greece, but its power was based on the genius of a single man and collapsed with his death at the battle of Mantinea (362 B.C.). Here Epaminondas once more saw his phalanx break the Spartan line, but as he pursued the retreating foe, he was pierced in the breast by a javelin. He was told by his physician that he would die as soon as the weapon was extracted. When news came that the victory was secure, he drew out the javelin with his own hand, saying, "I have lived long enough."

When Philip of Macedon invaded Greece a few years later, Thebes joined forces with Athens, influenced by the eloquence of the orator Demosthenes, and made a brave but unsuccessful stand in the decisive battle of Chaeronea (338 B.C.), bearing the brunt of the attack. At the accession of Alexander the Great to the Macedonian throne, Thebes attempted to recover its liberty, and was leveled to the ground in punishment. Though later rebuilt, it never again was an important city.

The present town of Thebes is called "Thivai" or "Phiva" in modern Greek. The Greek Thebes must not be confused with the ancient city of Thebes in Egypt, which was for centuries the capital of the Pharaohs (*see* Egypt).



On this house thermometer designed to show changes in temperature of the air indoors, you can readily compare the Fahrenheit and Centigrade scales.

THERMOM'ETER. The first thermometer or temperature-measuring instrument was made shortly before the close of the 16th century by Galileo, the famous Italian astronomer (*see* Galileo). It was an air-thermometer, quite different from the thermometers now in use and indeed only an indicating instrument. A few years later Galileo improved this by using alcohol instead of air. The principle of these early instruments was the same as that used in most thermometers of today, that liquids or gases when heated or cooled expand or contract faster than glass. So when colored alcohol, for example, is confined in a slender glass tube, the difference of expansion, indicated by the height at which it stands, is a measure of the temperature.

Mercury is used in most thermometers because it has a rather high boiling point (674° F.), a low freezing point (−38° F.), and a uniform expansion when warmed. For temperatures lower than −38° F. alcohol is used, because its freezing point is far below any cold encountered in Nature. For exceedingly high temperatures gas and electrical thermometers, usually called "pyrometers," are employed (*see* Pyrometer).

Ordinary thermometers are made by filling with mercury or colored alcohol a glass bulb provided with a slender glass tube. Heat is applied until the mercury overflows, when the top of the tube is sealed by melting the glass. As it cools the mercury contracts, leaving an almost perfect vacuum in the upper part of the tube. When the thermometer has become normal after the heating and cooling process, a scale for reading the changes in temperature is marked either on a strip of metal or porcelain used for backing, or on the glass itself. There are two temperatures that are easy to locate—the freezing point and the boiling point of water at sea-level. The thermometer is packed in melting ice to determine the height of the mercury at the freezing point of water; and to determine the boiling point, it is suspended in steam arising from boiling water. The space beween these two points is divided into uniform spaces called degrees, and the scale of degrees is extended the full length of the mercury column.

In the Centigrade scale, which is almost universally employed in science because of its greater convenience in reckoning, the freezing point is marked zero (0) and

the boiling point 100. In the Fahrenheit scale, which is in ordinary use in the English-speaking countries, the freezing point is marked 32 and the boiling point 212. This scale was devised early in the 18th century by Gabriel Daniel Fahrenheit, a German scientist, who found that a mixture of salt, water, and ice gave a temperature far below the freezing point. This point he marked as zero, dividing the intervening space to the boiling point into 212 degrees. In the Réaumur scale, much used in Germany, the freezing point is zero and the boiling point 80.

Usually temperatures are given only in one scale and it is well to know how to compare readings on both the Fahrenheit and Centigrade scales. To change readings on the Centigrade scale to the Fahrenheit scale, multiply by 9/5 and add 32. For example: 20 times 9/5 plus 32 equals 68. And 20° Centigrade is the same as 68° Fahrenheit. To change 68° Fahrenheit back to Centigrade, subtract 32 and multiply by 5/9, which gives you 20.

Thermometers play an important part in modern life. The doctor has a special kind called the "clinical thermometer" which he puts under your tongue when you are sick to see whether you have a fever. The normal temperature of the body is 98.4° Fahrenheit, and the clinical thermometer reads from about 93° Fahrenheit to 110° Fahrenheit, or from 35° Centigrade to 45° Centigrade. There is a little trap above the bulb to stop the mercury from descending when the thermometer is taken out of your mouth; this is so the doctor can read it accurately without its changing to the room temperature. Shaking brings the mercury down below this trap. The success of many manufacturing processes depends upon exact temperature control. Thus in making and tempering steel, melting glass, firing pottery, making chemicals, and in modern bakeries, thermometers and pyrometers are essential.

Many ingenious devices called "thermographs" have been invented for making a permanent record of temperature changes, as in the government weather bureau stations. In the simplest type a needle is attached to a spiral coil of metal which winds or unwinds as the temperature changes. This needle records its movements on a long roll of paper revolved by clockwork.

THERMOPYLAE (*thĕr-mŏp′ē-lē*). In this pass leading from northern to central Greece, King Leonidas of Sparta made his famous stand against the mighty army of King Xerxes of Persia in 480 B.C. With 300 Spartans he held the pass until the treacherous Ephialtes, a Thessalian, showed the Persians an unguarded path over the mountains, and allowed them to attack the Spartans in the rear. Here again, in 279 B.C., the Greeks held at bay an army of Gauls until these, too, found a way over the mountains.

Thermopylae means "hot gates" and takes its name from remarkable hot springs near by, which still exist. Besides one large spring used as a bath there are four smaller ones; the water, which is of a bluish green color and contains lime, salt, carbonic acid, and sulphur, is said to have curative properties in cases of scrofula, sciatica, and rheumatism. The pass, which lies between Mount Oeta and the sea, is not so narrow as in ancient times, for the wash of rains and nearby streams has built up the seaward side into a broad plain. A mound with some remains of the ancient monuments may still be seen. (*See* Persian Wars.)

THESEUS (*thē′sūs*). The greatest legendary hero of Athens was Theseus, said to have been the son of Aegeus, king of Athens. He was born and brought up in a far distant land, and his mother did not send him to Athens until he reached young manhood and was able to lift a stone under which his father had put a sword and a pair of sandals.

Arriving at length, after many dangers and adventures, Theseus found the city in deep mourning because it was time to send to Minos, king of Crete, the yearly tribute of seven youths and seven maidens to be devoured by the Minotaur, a terrible monster, half man, half bull. Theseus offered himself as one of the victims, hoping that he would be able to slay the monster. When he reached Crete, Ariadne, the beautiful daughter of the king, fell in love with him, and aided him by giving him a sword with which he killed the Minotaur, and a ball of thread by which he was able to find his way out of the winding labyrinth where the monster was kept. But he forgot the promise he had made to his father that if he succeeded in his undertaking he would hoist white sails on his ship when he returned, instead of the black ones with which the vessel had set out. The king, seeing the dark sails returning, and thinking that his son was dead, cast himself into the sea, which has since been called, after his name, the Aegean. Theseus now became king of the Athenians, and united the various village communities of the Attic plain into a strong and powerful nation. Many other brave deeds were ascribed to him. He was said to have been one of the Argonauts who went in search of the Golden Fleece, and in a war against the Amazons he conquered these famous women-warriors. He was once engaged in a contest of arms with Pirithoüs, king of the Lapithae, but the two heroes were so filled with admiration of each other that they swore eternal friendship. Theseus came to the aid of Pirithoüs in his struggle against the Centaurs (*see* Centaurs).

Theseus was killed by treachery during a revolt of the Athenians. In later times his memory was held in the greatest reverence, and at the battle of Marathon (490 B.C.) many of the Athenians fancied that they saw his spirit, clad in armor, charging at their head against the Persians. After the Persian Wars the oracle at Delphi ordered the Athenians to find the grave of Theseus on the island of Scyros, where he had been killed, and to bring back his bones to Attic soil. The oracle's instructions were obeyed, and the bones of Theseus are said to have been placed in the Theseum, a Doric temple whose ruins still stand in Athens to the north of the Acropolis.

THIRTY YEARS' WAR. Like the separate acts in a great tragic drama are the series of religious and political conflicts in Germany between 1618 and 1648 which together are known as the Thirty Years' War. No one wonders today why the struggle began in 1618, but rather why the war did not break out earlier.

After the Peace of Augsburg in 1555, Germany was divided into two hostile religious camps—Lutheran and Catholic. A third group, the Calvinists, had been shut out from all the religious and political advantages granted to the Lutherans by this peace. As a result they hated and were hated by both Lutherans and Catholics with almost equal violence. The quarrels between these religious bodies were in themselves bitter enough to cause a war and led to the formation of a Catholic League and a Protestant Union in 1608.

In addition, on Germany's frontiers were strong neighbors who were only too anxious to profit by her troubles. France on the west looked with envious eyes at the left bank of the Rhine. On the north Denmark longed to extend her territory beyond the base of her peninsula; while her Scandinavian neighbor, Sweden, hoped to make the Baltic a Swedish lake.

All through the latter part of the 16th century Germany was like a tinder box surrounded by a wall of flame. A religious war was raging in France; and the Netherlands was engaged in a deadly conflict with Spain wresting from her political and religious freedom. Small wonder that eventually the spark spread to Germany and that it, too, caught fire!

The Flame Spreads

The conflagration began in Bohemia, the land of John Huss. The Protestants of that country revolted against their rigidly Catholic king, a member of the powerful Hapsburg family, who in a short time was elected emperor as Ferdinand II. He was not only bigoted in religious matters but stood for the plan to make the Bohemian crown hereditary in the Hapsburg line. May 23, 1618, his representatives were thrown out of a window at Prague, and Frederick, the count palatine of the Rhine and son-in-law of James I of England, the leading Calvinist prince in Germany, was elected king of Bohemia. The powerful Lutheran princes of Saxony and Brandenburg remained neutral for a long time. Frederick's support and Spanish and Jesuit activity caused the conflagration to spread until it involved all Germany. The Bohemian struggle was short. Frederick was defeated at White Mountain Nov. 18, 1620. The troubles of the empire furnished the opportunity for its neighbors to interfere, and a war that had started in Bohemia became a European conflict in which at different times Spain and Denmark took active parts, Sweden played a chief rôle, and France was the principal actor.

After the Bohemian period (1618–24) the struggle became a European conflict with three chief periods in it. In the first, 1625–29, King Christian of Denmark appeared as the champion of the German Protestants. He was no match, however, for the army of the Catholic League under Tilly or for the able Imperial general Wallenstein who, without cost to the emperor, raised a large army drawn from every country of Europe but devoted to their leader.

The hero of the second period was the Swedish king, Gustavus Adolphus, likewise a Protestant champion. His brilliant victories over Tilly, a Catholic leader second only to Wallenstein in ability, forced the emperor to recall his former champion, Wallenstein, who had been dismissed at the demand of the Catholic princes. The period practically closed with the death of the military genius Gustavus Adolphus in 1632 (*see* Gustavus Adolphus). Wallenstein was again dismissed by the emperor and assassinated in 1633.

But in the meantime the turning point had been reached in 1628–29. In those years the apparently invincible Wallenstein failed to take the Protestant city of Stralsund on the Baltic after weeks spent in besieging it. In 1629 the emperor proclaimed the restitution of all lands taken from the Catholic church since 1552. Their selfish interests now urged all Protestant princes to fight against the Army of the Catholic League and against Wallenstein, who cared nothing for religion but had plans for his own power and for a strong German empire. The French Protestant city, Rochelle, fell before an equally stubborn siege conducted by Louis XIII and his minister, Cardinal Richelieu. This was the end of political privileges for the Protestant Huguenots of France. But the Protestant defeat in France was a Protestant triumph in Germany, for it freed Richelieu from troubles at home and enabled him to interfere actively in Germany, first in support of Gustavus Adolphus and then independently.

Thus the last period was the French, 1635–48, when Richelieu and Mazarin used the French armies under Turenne to secure French dominance. That a Catholic country under cardinals of the church as leaders should interfere in behalf of the German Protestants shows that the war had ceased to be a religious conflict. It was by this time a scramble for more territory. In the scramble the Spanish Hapsburgs aided the Austrian Hapsburgs against the German Protestants, Sweden, and France.

The Desolation of War

By this time the people of Germany were too wretched to care much which side won. For 17 years armies had marched back and forth across the country and any wealth that escaped falling into the hands of the foe was taken by friends. Indeed to most of the people Catholic and Protestant armies were alike evils to be dreaded. All except that of Gustavus Adolphus had lived on the country through which they passed, until by the close of the war in 1648 there was little left but desolation. The starving inhabitants in battle areas followed the armies as hangers-on. Education and morals disappeared with their homes. In one district where before the war there had been 1,717 houses, only 627 remained and of these many were untenanted for only 316 families could be found in the district. The flourishing city

of Augsburg was left with 16,000 inhabitants in place of 80,000. Other cities and villages were entirely wiped out and many of them were never rebuilt. The clock of history in Germany was turned backward two centuries by the horrors of the Thirty Years' War.

All parties were exhausted and in 1641 peace was seriously discussed. But the war went on, for the questions involved were so complicated that it was not until 1648 that the Treaty of Westphalia was finally signed. The religious settlement recognized Calvinism. The princes of Germany might choose the religion for their land —Catholic, Lutheran, or Calvinist; church lands were to belong to the sect that held them in 1624.

The political questions were more difficult to settle but France and Sweden really determined the division of Germany. In the end Sweden received extensive territories on the German coasts of the Baltic and North seas; France obtained Alsace; the Lutheran states of Saxony and Brandenburg (Prussia) in Germany received additional territories; Spain acknowledged the independence of the United Netherlands (Holland), and Swiss independence was confirmed. The princes of Germany became practically sovereign with power to form foreign alliances and any possibility of a united Germany was further limited by decreasing the power of the emperor and the Diet. The Holy Roman Empire of the German people continued a formal existence until 1806 but it was only a hollow shell. Richelieu's plan of making France dominant in Europe was realized in the reign of Louis XIV.

THISTLE. When King Alexander III was king of Scotland (1241–1285), King Haakon of Norway landed an army on the shores of that kingdom and attempted to conquer it. But in his night attack on the Scottish camp at Largs, a barefoot Norseman trod on a thistle and cried out in pain. The Scots took the alarm, the attack failed, and soon afterward King Haakon had to withdraw his army and surrender the Hebrides Islands to Scotland. In remembrance of the battle of Largs, the Scots adopted the prickly purple thistle for their national emblem. In 1540 an order of knighthood, called the "Order of the Thistle" or "Order of St. Andrew" was established by King James V of Scotland.

THE NATIONAL EMBLEM OF SCOTLAND

The Spear Thistle (*Carduus lanceolatus*) seems to be the original Scotch thistle. That honor is also claimed for other thistles, but this spiny variety appears to have the best claim.

Several varieties of this vigorous plant are distributed over the United States. They are mostly weeds, although many of them, with their stout stems and spiny leaves, surmounted by soft silky flowerheads of purple, pink, yellow, or white, are very handsome. They are very hard to eradicate, however, and are a source of never-ending annoyance to the farmer. The Canada thistle especially —known also as corn thistle, creeping thistle and Scotch thistle—is a great nuisance in the New World, to which it has found its way from the Old. This variety grows from one to three feet high, and has small rose-colored flowers. Like all thistles, the flower heads form large downy seed balls, which the wind scatters far and wide. The long fleshy underground stems, found just below the level usually reached by the plow, are hard to tear out, and any little piece of root left in the ground will form a new plant.

THE WILD TEASEL

The Teasel does not belong to the thistle family, but in general use it often gets the name. One species, called the "Fuller's Teasel," is cultivated because its heads are set with hooked spines and are used for "fulling" or raising the nap on woolen goods.

The beauty of a few varieties of thistle has won for them a place in many gardens, particularly the blue-flowered globe-thistle, and the cotton thistle, a tall branching plant with large spiny leaves covered with white cotton-like hairs. The latter variety grows wild in some parts of the United States. The milk thistle is sometimes cultivated for its root stalks, which are eaten like salsify.

The teasel, a native of southern Europe, but cultivated in the United States and elsewhere, is widely used in cloth-making. The heads are cut off when in flower and dried. Their oblong hook-pointed prickles are used

for "fulling" or raising the nap of cloth, and do the work better than any mechanical device which has been so far invented.

A number of plants similar to the thistle are sometimes called by that name, among them the spiny Russian thistle or tumbleweed, a curious and common plant of the western United States.

Scientific name of Canada thistle, *Carduus arvensis;* of the fuller's teasel, *Dipsacus fullonum.* The *Carduus lanceolatus* seems to be the prototype for the national emblem of Scotland, although that honor is often claimed for the cotton thistle, *Onopordon acanthium.*

THOMAS, GEN. GEORGE HENRY (1816–1870). "The Rock of Chickamauga" was the title given to General Thomas because of the steadfastness with which he held his position on that famous battlefield in the Civil War. This steadfastness of courage and purpose made him a great general even in the midst of defeat.

A Virginian by birth, he received his military training at West Point, graduating in 1840 as a classmate of Gen. William T. Sherman. His first military experience was gained in campaigns against the Indians and in the Mexican War. On the outbreak of the Civil War, he decided after much hesitation to remain loyal to the Union. He was made a brigadier-general and was sent into the valley of Virginia to aid the Unionists of that region. Soon he was transferred to Kentucky, where he defeated the Confederate forces in January 1862. For this victory he was promoted to the rank of major-general of the volunteer army.

General Thomas' remaining service in the War of Secession was all in the West. In the hard-fought battle of Stone River, Tenn., he rendered conspicuous service, showing his characteristic quality of steadfastness. At Chickamauga (Sept. 19–20, 1863)—one of the fiercest battles of the war, involving Union losses of 16,000 and Confederate losses of 18,000—when the Union right was routed and General Rosecrans, the commander, gave up the field for lost, General Thomas held his position on the left against repeated attacks of the victorious Confederates, thus saving the army. In the battle of Missionary Ridge (Nov. 25, 1863) his troops carried the enemy's rifle-pits at the base of the ridge, scaled the heights, and captured the Confederate lines on the crest.

During the Atlanta campaign, which ended in the capture of that city, Thomas rendered conspicuous service. When Sherman started on his march through Georgia, he left Thomas to oppose the Confederate army under General Hood, who moved into Tennessee. Thomas hurried to Nashville, but when his opponent appeared before that city he delayed to attack, taking time to organize and equip the new troops that had been sent to him. Fault was found with him for his slowness to act, and an order was given for his removal. Before the order reached him, however, General Thomas had attacked and completely crushed Hood's army, on Dec. 16, 1864, winning one of the important victories of the Civil War. For this victory he received the thanks of President Lincoln and of Congress, was promoted to the rank of major-general in the regular army, and was given a gold medal by the state of Tennessee.

After the war General Thomas remained in the army and was in charge of several military districts. He declined the rank of lieutenant-general, which was offered him, saying that he had done nothing since the war to merit promotion.

No officer in the Civil War inspired in his men a greater measure of enthusiasm and personal devotion than "Old Pap" Thomas, as he was affectionately called by his soldiers; and as a commander he showed qualities of the highest order.

THOR. Ages ago, according to the myths of the Northland, there lived a powerful young god named Thor. It was he who chased away the frost and called gentle winds and warm spring rains to release the earth from its bondage of ice and snow. The lightning's flash was his mighty hammer Mjölnir, hurled in battle with the frost giants, and the rolling thunder was the rumble of his fiery chariot.

I am the god Thor,
I am the war god.
I am the Thunderer!
Here in my Northland,
My fastness and fortress,
Reign I forever!

Here amid icebergs
Rule I the nations;
This is my hammer,
Mjölnir, the mighty;
Giants and sorcerers
Cannot withstand it.
—*Longfellow.*

Thor was a good-natured, careless god, always ready for adventure, and never tired of trying his great strength. He could shoulder giant oaks with the greatest of ease and slay bulls with his bare hands. For sport he sometimes rode among the cloud-veiled mountains, hurling his hammer at their peaks and cleaving them in twain.

This adventurous god once visited Jotunheim, the land of the frost giants. The king of the giants looked at him scornfully and said: "Is this stripling the mighty god Thor? Perhaps you are mightier than you appear. What feats do you deem yourself skilled in?"

"I will test my prowess in a drinking bout with anyone," said Thor, his eyes flashing fire.

The king thereupon bade the cupbearer bring a drinking horn and said: "Whosoever is a good drinker is able to drain this horn at a single draught." Thor placed the horn to his lips and drank long and deep, but when he removed it the liquid had scarcely diminished. Three times he tried to empty the horn and failed, and at last he threw it down in disgust.

Next he attempted to lift the king's cat from the ground, but only succeeded in raising one of its paws. The giants jeered and shouted, saying, "Is this the mighty god whom we have been taught to fear?"

Thor then offered to wrestle with anyone who would stand against him, and a toothless old woman accepted the challenge. With mad rushes Thor

THOR STRIVES IN VAIN TO OVERCOME OLD AGE

Once, when Thor visited Jotunheim, the land of the frost giants, the King of the Giants realized that Thor was stronger than any of his people, and that only trickery could overcome the mighty god. So he taunted Thor, calling him a stripling, until Thor offered to prove his strength and endurance. In each of these feats he failed, not because he was weaker than the giants, but because the King had tricked him into three impossible tasks. Here you see him at his third task, trying to overcome Old Age, whom no man may conquer. But he held her off for a long time, and as the King of the Giants said, to stand against the old crone for so long a time was marvelous. The King and his warriors looked on in amazement at the god's strength, until finally he gave up in disgust and fled from the palace.

contained in the Easy Reference Fact-Index at the end of this work

attempted to throw the old crone to the floor, but in spite of all his efforts could not succeed. In shame he left the palace. When safely outside its gates, the king of the giants came to him and said: "Mighty Thor, when you attempted to empty the drinking horn you performed a feat so marvelous that, had I not seen it myself, I should never have believed it. The sea itself lay at the end of that horn, and when you come to the shore you will see how much of the waters have fallen away. Terror overcame me when you lifted the cat's paw from the floor, for that cat is the serpent Midgard, who encircles the earth, and the whole world shuddered when its hold was loosened. To stand against the old crone for so long a time was marvelous, for it was indeed Old Age with whom you wrestled, and no man may conquer her. Magic, and not the prowess of the frost giants, has overcome you."

Thor, in wrath at being so tricked, reached for his hammer; but when he would have thrown it, the giant had disappeared.

This is but one of the many stories told of the powerful Thor. In his honor the fifth day of the week is still called "Thor's day," or Thursday.

THOREAU
The Sage of Walden Pond

THOREAU (*thō-rō'*), **HENRY DAVID** (1817–1862). At the age of 28 Henry Thoreau, Harvard graduate and carpenter, scholar and woodsman, resolved to simplify his life. He felt that he was paying too dearly for his livelihood. "The cost of a thing," he wrote, "is the amount of what I will call *life* which is required to be exchanged for it"; and Thoreau decided that the various employments he had tried his hand at—surveying, carpentry, school-teaching, pencil-making—all took more of his life than he was willing to exchange for a living.

"To maintain one's self on this earth is not a hardship but a pastime, if we will live simply and wisely," he said; and acting on this theory he went off to see how cheaply he could live on the shore of Walden Pond, near his native town of Concord, Mass. He borrowed an ax and built a cabin with a capacious fireplace. He cleared a little patch of ground and raised beans, peas, potatoes, and sweet corn. Such money as he needed to buy clothing and the foodstuffs he could not raise, he obtained by selling some of his vegetables and by working at one of his trades for six weeks during the summer. By thus reducing the machinery of life to its lowest terms, Thoreau supported himself for two years at an average cost of 27 cents a week, and of only six weeks' paid labor out of the 52 weeks of the year.

He has left us an account of his experience in his 'Walden', one of the most interesting and stimulating works in American literature. Nature and great books were the things he chiefly loved, and the leisure he won by simplifying his life he spent in thinking and writing. He got close to the life of the animals, which loved him as he loved them. The birds, forgetting their fear of man, came at his call; the beasts were his friends; even the fish glided unafraid between his hands.

When Thoreau had had enough of this hermit life, he quietly returned to Concord and spent his remaining days there, writing much, sometimes lecturing, and sometimes making pencils for a living. Consumption carried him off at 45, despite his open air life.

Fond of solitude as Thoreau was, he had a few close friends, of whom Emerson was one of the closest. In manner he was outspoken, he made no effort to please, and to many appeared cold; but those who penetrated beneath the outward appearance found in him warm sympathy, cheerfulness of disposition, a high and deep spirituality, and the wisdom that comes to those who have lived close to reality.

Emerson sums up his life in these words: "He was bred to no profession; he never married; he lived alone; he never went to church; he never voted; he refused to pay a tax to the state; he ate no flesh; he drank no wine; he never knew the use of tobacco; and, though a naturalist, he used neither trap nor gun."

Thoreau's works are: 'A Week on the Concord and Merrimac Rivers' (1849); 'Walden, or, Life in the Woods' (1854); 'Excursions' (1863); 'The Maine Woods' (1864); 'Cape Cod' (1865); 'Letters' (1865); 'A Yankee in Canada' (1866); 'Early Spring in Massachusetts' (1881); 'Summer' (1884); 'Winter' (1887); 'Autumn' (1892); 'Miscellanies' (1893); 'Journals' edited by Bradford Torry (1906).

Perhaps this mother Thrasher has heard something about the conservation of food. Certainly she is making sure that no morsel of the food which she has for her youngster shall be lost. You will notice that the baby has a good-sized "intake."

THRASHER. The flute, the violin, and the clarionet are all represented in the beautiful notes poured forth by the brown thrasher, one of our most delightful song-birds, as he sits on a conspicuous perch at the top of a tree or bush and gives a concert for all the

For any subject not found in its alphabetical place see information

world within hearing. He is often mistaken for the mocking-bird, and like that bird-artist he frequently sings on moonlit nights. He sings in an impassioned manner, and one author has said: "As the fervor increases his long and elegant tail droops; all his feathers separate; his whole plumage lifted, it floats, trembles; his head is raised and his bill is wide open; there is no mistake; it is the power of the god." And not only as a singer does the brown thrasher excite our admiration, but as a warrior, for his courage in protecting his family often amounts to positive heroism. His habit of switching his tail about when he is angry probably accounts for the name thrasher.

There are several species of thrashers, which with the mocking-bird and the catbird make up the group of "mimic thrushes," found only in America. The brown thrasher (*Toxostoma rufum*) is found in the eastern United States ranging north to Canada and west to the Rockies. It is about 11 inches long, with a bright brown coat and a buff-colored breast streaked with brown. The bill is long and curved downward at the end, and the short wings and much longer tail are rounded.

THREAD. A century and a quarter ago the convenient spool of cotton thread, so indispensable today to the housewife and the garment manufacturer, was unknown. The only thread used was hand-twisted linen thread sold in hanks just as knitting yarn is today. The idea of using cotton fiber for thread was hit upon by an American woman, Mrs. Samuel Slater of Pawtucket, R.I., in 1794. Today many great factories employing thousands of people are manufacturing the world's thread. The industry in the United States is centered in the New England states. Paisley is the center of thread-making in Scotland and Manchester in England. Linen thread, which is still used where great strength is required, as for example in sewing on buttons, is made chiefly in Ireland.

The best grades are made from the long-fibered Sea Island cotton. It is spun just as for weaving (*see* Cotton; Spinning and Weaving). But these threads are very fine, and a number of them must be twisted together before a thread strong enough for sewing can be made.

The spools upon which the thread is wound are made in one of the most interesting sections of the factory. Immense stacks of wood are cut into bars a few feet long and measuring less than two inches square, and these bars are made into little round rods in a "turning" machine. Cut into spool lengths, the pieces are fed to a boring machine that pierces them lengthwise, making round holes through the center so that the spool can be mounted on a sewing machine. Then a cutting machine shaves off a ribbon of wood from each, and the spool is finished.

The winding machine has many revolving spindles, on each of which a spool is held while the thread is wound, a guide traveling to and fro spreading the thread evenly over its surface. When the proper amount has been wound, the spindle stops, and a metal finger moves across the spool, catching the loose thread. At the same time a knife comes up and cuts a notch in the flange. The first finger carries the thread over the notch, and a second finger catches it and pulls it firmly down. As the thread is cut free the filled spool is pushed off, an empty one taking its place. The round paper labels are stuck on both ends at once by another ingenious machine. The number on the label indicates the size of the thread, "60" indicating a finer thread than "40."

THRESHING. The ancient method of shelling out grain was by rubbing the heads between the hands, treading out the grain with the oxen on the threshing floor, or pounding the grain with ponderous hand-flails—two sticks hinged together by a stout thong. When threshing was done with the hand flail, and the grain was winnowed by tossing it up so that the wind might carry away the chaff, the work occupied much of the time of autumn and winter. This work a modern threshing machine now accomplishes in a few hours, though the primitive methods still prevail in many backward regions of the world.

The first really successful threshing machine was invented by a Scotch mechanic named Andrew Meikle, in 1786. Little was done toward improving it and putting it to work until 1840, but the development of the modern American thresher followed rapidly after that date.

Threshing on a modern farm is a fascinating operation. On a hot sunny day in summer the threshing machine, drawn by a steam engine or gasoline tractor, labors clumsily along the road and turns in at the farmyard gate. Soon a steady hum announces that the work has begun, and the sheaves disappear rapidly down the broad throat of the monster. Two men are kept busy pitching the bundles to the self-feeder. Keen knives automatically cut the binding twine and the loosened grain is drawn between the teeth of a rapidly whirling cylinder which shells out most of the grain. Pickers, beaters, and shaking forks, which cause the huge frame of the machine to vibrate with their tireless energy, complete the separation. The chaff and refuse are removed by a set of screens and a fan blast. The grain is then automatically weighed or measured and run into sacks ready to be hauled away. The straw and chaff are carried by an elevator or stacker to the top of a stack, where it is built up into a compact even pile.

A threshing machine is so wonderful that it can almost work alone. But in addition to the men who load the wagons in the field, drive them to the machine, feed in the sheaves, and carry away the grain, one man must tend the engine, another oil and adjust the thresher, and still others help shape and pack down the stacked straw. A modern threshing crew often consists of 18 men, and can thresh 2,000 bushels of grain a day.

The thresher may be adjusted to different grains, but there are also special machines for threshing

clover, rice, peanuts, peas, and beans, and for husking corn and shredding the fodder. Owing to the high cost of threshing machines, and the short time a farmer needs one each year, usually one man in a neighborhood owns an outfit and does all the threshing. Sometimes the farmers form a coöperative association for this purpose.

THRUSH. The large thrush family with its 150 species boasts some of the finest musical artists in birdland. Among its famous members are the robin, the bluebird, and the nightingale, as well as those commonly known by the family name. In general appearance the different species vary in size and coloration. Most are feathered in browns and buffs; others, as the robin and bluebird (for illustration in colors *see* Birds) show bright colors. But whatever the color of the parent birds, all young thrushes, until their first autumn molt, have spotted breasts. Some of the species live in trees, others on the ground; some feed on insects, others on fruits, and some eat both.

THE SONG OR WOOD THRUSH

The Wood Thrush is a great favorite among bird lovers because of his sweet song. He is smaller than the robin, being about 7 or 8 inches long. His head is brown, changing from a bright cinnamon at the head to a light olive brown at the tail, and underneath he is marked by large round black spots.

Thrushes are almost cosmopolitan. In England the song-thrush or mavis, the missel-thrush, and the nightingale are the best known species. The song of the mavis is so musical as to frequently be mistaken for that of the nightingale.

The family is well represented in the New World. In the United States the wood-thrush and hermit-thrush are two of its finest species. These are slender birds, about seven inches long, and both have spotted breasts. Both are wonderful singers. The hermit, a bit the smaller of the two, nests on the ground, and the wood-thrush in low bushes. Both lay three or four greenish-blue eggs. Wilson's thrush or veery is similar in appearance and nesting habit, though most retiring in disposition. His song, as described by Ernest Thompson Seton, is a soft silvery tinkling, suggesting the syllables *veero, veery, veery, veery*, which doubtless gave the bird his name. (*See also* Bluebird; Nightingale; Robin.)

Scientific name of thrush family, *Turdidae;* of the wood-thrush, *Hylocichla mustelina;* hermit-thrush, *Hylocichla guttata;* veery, *Hylocichla fuscescens.*

TIBER RIVER. The swift-flowing stream on which ancient Rome was built is laden with historic memories and associations. Many are the triumphs the river witnessed in the days of imperial Rome's greatness, many are the dark deeds done on its banks, and many times have its yellow waters run red with blood. The Romans fondly called it "Father Tiber"; for they loved the stream which watered their land, joined the city with the sea, and helped to protect them from invasion. Yet sometimes the river god appeared to be angry, for the swelling waters rushed over the land in disastrous floods; as indeed they have done even in recent times, though massive embankments have lessened this danger.

Beginning as a little bubbling mountain brook on the western slopes of the Apennines, the Tiber is joined by other small streams as it flows southward and westward to the Mediterranean. As it gains in force and volume, it gathers great quantities of tawny clay, which gives it its famous yellow color. So much sediment has been deposited at its mouth that Ostia, the ancient port of Rome, is now more than four miles inland. The Tiber is the most important stream of Italy south of the valley of the Po. Along its winding course of 245 miles are many cities, chief of which is Perugia, which like Rome is filled with interesting remains of ancient days. The Tiber is navigable for small steamers to Rome, 17 miles from its mouth, and for lighter boats for about 60 miles farther up.

How Horatius Kept the Bridge

IN the brave days of old—according to an ancient legend told by the Romans and retold by Macaulay in his stirring 'Lays of Ancient Rome'—the city of Rome was threatened by an invasion from the neighboring state of Etruria. A line of Etruscan kings before this time had ruled over Rome, but the last of the Tarquins, as this line was called, had been expelled, and Rome had become a republic. Now in order to reëstablish their power, the Etruscan leader, Lars Porsena of Clusium, had raised a large army and was marching toward Rome, burning villages and causing the homeless people to flee in terror to the city walls.

News came that the Etruscans had taken the Janiculum, the outpost on the Tiber's farther shore and would cross the bridge into Rome. "The bridge must straight go down," ordered the consul, but hardly had he spoken when he realized that the vanguard of the army would be upon them before this could be done.

Then up rose a brave Roman named Horatius, who offered at the risk of his life to hold the Etruscans at bay while the Romans cut the bridge down. Two of his friends took their places by his side, while their countrymen seized their axes and smote upon the stout timbers which supported the bridge.

Meanwhile the Tuscan army,
Right glorious to behold,
Came flashing back the noonday light,
Rank behind rank, like surges bright
Of a broad sea of gold.
Four hundred trumpets sounded
A peal of warlike glee,
As that great host, with measured tread,
And spears advanced, and ensigns spread,
Rolled slowly toward the bridge's head,
Where stood the dauntless Three.

Against that great host these three men stood their ground and smote one after another of the famed Etruscan leaders. Horatius himself received a blow from the boldest of them all, but "like a wildcat mad with wounds" he turned fiercely upon his assailant and slew him, striking terror into the hearts of all the foe.

And now, so well had the Romans worked at the bridge that it hung tottering over the foaming tide. "Back ere the ruin fall!" cried the Fathers of the city. The two companions of Horatius darted back, but brave Horatius stood alone on the other side until the bridge fell crashing into the foaming Tiber. Then he turned toward the river with these words:

O Tiber! Father Tiber!
To whom the Romans pray,
A Roman's life, a Roman's arms,
Take thou in charge this day!

and plunged into the stream. The current was swift, for the river was swollen with months of rain. But bravely did Horatius struggle, in spite of his wound and his heavy armor, and the good Father Tiber bore him safe to shore. He was received with shouts of joy, and rewarded with land,

As much as two strong oxen
Could plough from morn till night.

A statue was erected to his honor in the public square and ever afterward his countrymen loved to tell the story of his heroism.

WHEN HORATIUS SAVED ROME

But friends and foes in dumb surprise,
With parted lips and straining eyes,
Stood gazing where he sank;
And when above the surges
They saw his crest appear,
All Rome sent forth a rapturous cry.
And even the ranks of Tuscany
Could scarce forebear to cheer.

TIBET'. If you should scale the sides of Mount Everest, the highest peak on earth, which juts out of the Himalayan range of upper India, and should look northward, you would see mysterious Tibet, the country that has been called the "top of the world." No other part of the earth's surface is so crowded with massive and lofty mountains. Even the valleys of Tibet are higher above the sea than the tallest peaks of the Rockies, for the mean altitude of the entire table-land is 15,600 feet.

It is a barren, rocky, windswept land that marches upward from the Himalayas toward central China—as if the hungry earth were showing gaunt teeth. Most parts of the land are dry and cold, others are swept with rain, hail, and snow the year around, while still others suffer from intense summer heat. The northern plateau of Tibet, an area about as big as France, is dotted with innumerable large and small lakes, often salty or alkaline; while the boggy country in between bears stunted vegetation. Occasionally great pillars of salt stand out, carved by the action of wind and cold, while near by perhaps is a hot spring, whose overflow has been frozen solid by the bitter wind. Here are found the yak, the wild ass, deer, antelope, wild sheep, wild goats, bears, leopards, wildcats, otters, wolves, foxes, and wild dogs—all in great numbers.

The general atmosphere of bleak desolation is relieved by a great valley splitting the country in two from east to west. Here flow the headwaters of the great Brahmaputra River, which later forces its way through the eastern end of the Himalayas into India, where it joins the many-mouthed Ganges before flowing into the Bay of Bengal. Not far from the source of the Brahmaputra rises the historic Indus, which flows around the other end of the Himalayas into the Arabian Sea. In the Brahmaputra valley protected mountain sides are covered with fine forests, fruit trees can be cultivated, and fields are green with barley, buckwheat, and a few vegetables. Here dwell most of the inhabitants.

The customs of the Tibetans are primitive, and their trades and industries few. Mostly small farmers

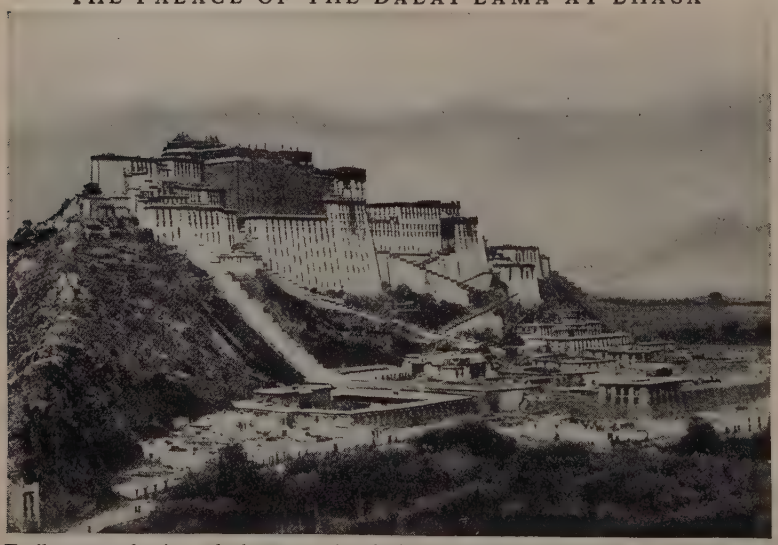
or keepers of flocks, they manufacture woolen cloths, rugs, pottery, and small articles of metal. The country is rich, however, in undeveloped mineral resources. Gold is found almost everywhere. In the rivers of the north and northeastern portions handfuls of pure yellow nuggets have been picked out from the sands in a few hours. But the difficulties of transportation and heavy tribute levied by officials have prevented mining from developing on any large scale. There are no railways. Numerous trade routes connect Lhasa with China and India. Pack-trains from Mongolia bring leather and European jewelry, of which the Tibetans are exceedingly fond. From China the Tibetans buy silk, carpets, porcelains, and large quantities of tea.

The headquarters of Lamaism, the national religion, are at Lhasa, a walled city long known as "Forbidden Lhasa." The Grand Lama, or Dalai Lama, whose palace is near Lhasa, rules central Tibet through thousands of lesser priests and monks, who hold political sway. Spiritual affairs, however, are chiefly centered in the hands of the Tashi Lama, the head of a famous monastery at Tashilunpo. Lamaism is a strange combination of Buddhism, sorcery, and certain ancient Indian faiths.

HOW TIBETANS GRIND THEIR GRAIN

The Yak is really a species of ox, and the Tibetans use him as their beast of burden, just as primitive peoples in other parts of the world have used the ordinary ox. Here are two yaks dragging between them a huge stone over a threshing floor. The movement of this stone, back and forth, grinds the grains of barley, the chief article of food in Tibet.

THE PALACE OF THE DALAI LAMA AT LHASA



Until 1904 no foreigner had ever set foot inside the walled city of Lhasa. "Forbidden Lhasa" it was to the outside world, and many were the strange tales which were told about the mysteries of Lamaism, the national religion. But in 1904 a British expedition captured the city, and for the first time foreigners climbed the three flights of stairs and the four ladders which are the only means of entrance into the palace from which the Dalai Lama surveyed his capital city.

For centuries Tibet was a closed country to Europeans. Bold explorers who attempted to enter it were killed or driven out. A partial breaking down of the barrier came in 1904, when Col. F. E. Younghusband led an armed British expedition to Lhasa and forced the Tibetans to discontinue hostile demonstrations against the Indian frontier. British trading posts were also to be allowed at certain points.

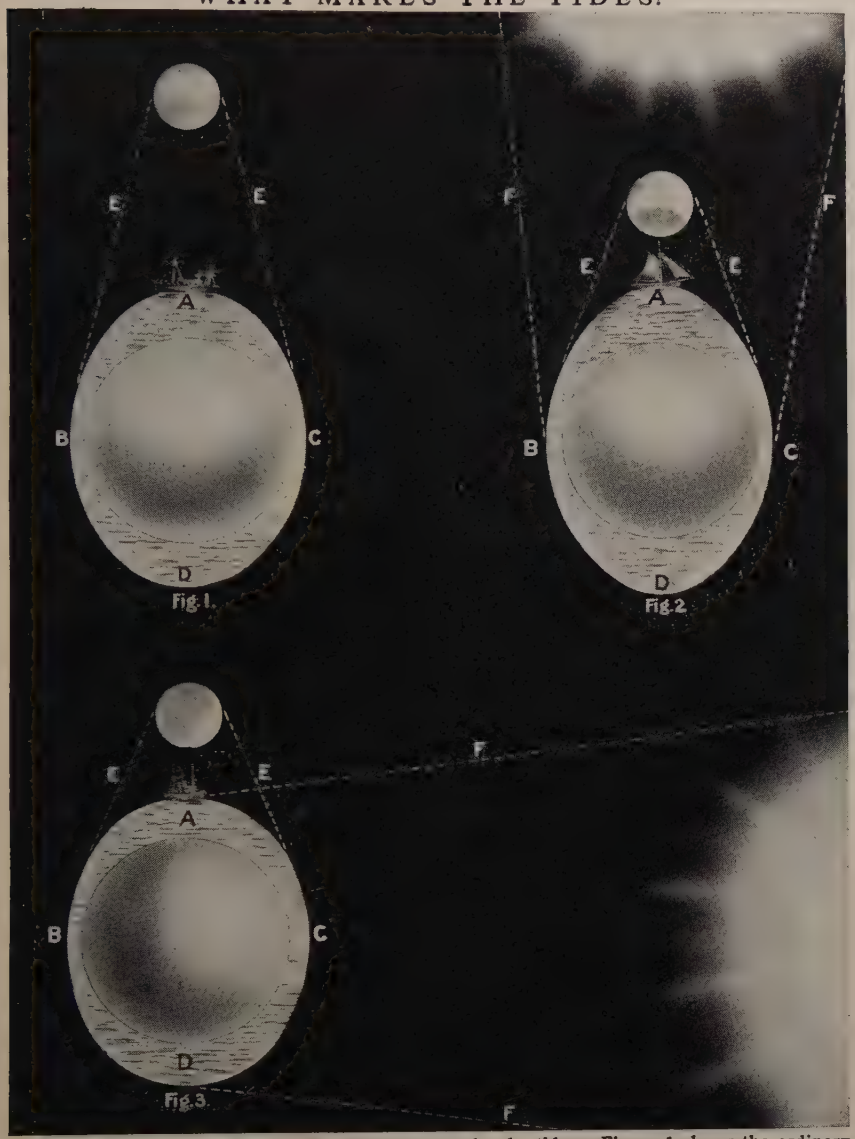
Tibet was for long a part of the Chinese Empire, paying tribute to Peking. During the Chinese revolution of 1911 the Tibetans drove out the Chinese garrisons and Great Britain refused to allow them to return. Thus Tibet today stands virtually independent, although China still claims sovereignty over it. The area of Tibet is about 463,000 square miles; population, probably about 2,000,000.

TIDE. Everyone who has lived by the ocean has noticed how the waters creep slowly up the beach for six hours, and then for six hours slip steadily down again. The connection of this movement with the moon was noted very early, but until Sir Isaac Newton's discovery of the law of gravitation the cause of this endless rise and fall of the ocean could not be explained. It is now known to be due to the pull of the moon on the earth, sometimes helped and sometimes hindered by the sun, depending upon whether these two bodies are in a straight line and pull on the earth together, or whether they pull in different directions. The moon is so much nearer to the earth than the sun that, although its mass is far less, its tide-raising force is more than twice the tide-raising force of the sun.

For any subject not found in its alphabetical place see information

Whenever the moon rises over the ocean, it heaps up the water that is just under it. So a great wave, or tide, is started traveling across the wide sea, making high tide. Then by reason of the earth's movement in 24 hours and 51 minutes). At the same time that the moon lifts the water on the side nearest it, it pulls away the earth from the water on the opposite side, which causes another heaping up of water at that point. Thus there are always two high tides opposite each other, and two low tides at equal distances between them.

WHAT MAKES THE TIDES?



This diagram shows you how the sun and moon make the tides. Figure 1 shows the ordinary lunar tide, by which the moon, acting along the lines of attraction EE, heaps up the waters of the sea on the side nearest the moon (A), causing high tide at that point and low tides at B and C; at the same time, the waters at D, being further away, feel the pull of the moon considerably less than does the Earth as a whole, so they tend to be "left behind," so to speak, and pile up in the opposite direction. In Figure 2 you see the higher or "spring" tide produced when the sun and moon are in line, FF being the lines of attraction of the sun and EE of the moon. Figure 3 shows the "neap" tide when the sun and moon are pulling at right angles, thus counteracting somewhat each other's influence.

Twice in the course of every month, when the moon is new or full, it comes into a line with the sun. At these times both attract the earth from the same direction, and the higher tides which are produced are called "spring" tides. These have nothing to do with the season of the year. "Neap" (meaning "nipped" or "scanty") tides, which occur near the first and third quarters of the moon, are low, because the sun and moon are then pulling in opposite directions.

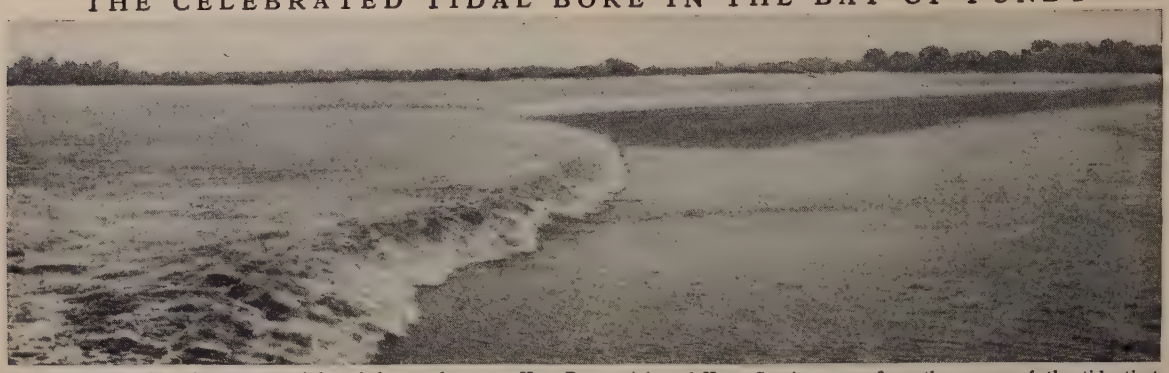
In the mouths of some rivers, and sometimes in sharply narrowing ocean inlets, the result of the rising of the spring tide is occasionally very picturesque. The tides overcome the current of the river, and a single high wave, moving onward like a wall of water, rushes with great violence and a roaring noise up the river bed. This phenomenon is called a "bore" or an "eagre." In one branch of the Ganges the bore travels 70 miles in 4 hours, and often appears suddenly as a wall 7 feet high, while in the mouth of the Amazon it reaches a height of 5 to 12 feet.

The extent of the rise and fall of the tide varies in different places. In mid-ocean the difference between high and low water is usually two to three feet, while on the shores of great continents, especially in gradually narrowing bays, the height is often very great. The average spring tide at New York is about $5\frac{1}{2}$ feet, in Boston about 11, and in the Bay of Fundy it often rises to 60 feet and sometimes more. Lake tides are too small to

the moon is left far behind, and the water goes back to its own level.

This is called the "direct" tide. There is also the "opposite" tide, which occurs at the same time on the opposite side of the earth, and explains why we have two high tides in every 24 hours (or, more exactly,

THE CELEBRATED TIDAL BORE IN THE BAY OF FUNDY



The Bay of Fundy, a long narrow inlet of the sea between New Brunswick and Nova Scotia, so confines the sweep of the tide that tremendous tidal waves or "bores" often result. At Moncton, New Brunswick, where this photograph was taken, the normal difference between high and low tide is 30 feet. You can see the wall of water rushing toward the shore.

be noticeable, that of Lake Michigan being lèss than two inches; and in landlocked seas like the Mediterranean the tides are also very slight.

A knowledge of tides is very important to the navigator, as the question of a foot or two in depth on a dangerous shoal may involve the lives and property on the ship. Governments therefore furnish tables showing the fluctuations at all important ports for every hour and every day for as much as a year ahead. These are calculated by complicated machines called "tide predictors."

Many men have puzzled over the problem of how to utilize the tremendous energy created when the moon lifts and lets fall these billions of tons of water twice each day. If this power could be harnessed it could run all the factories without using an ounce of coal, all the railroads, trolleys, subways, and electric automobiles, and produce all the electric light. Up to this time, however, no practical scheme has been devised. One plan proposed is to build enormous basins where the tide rises high. The tide would flow into these basins twice a day, but the water would be allowed to escape only through tunnels containing turbines similar to those at Niagara. While this plan is probably practicable, the great expense connected with building and operating such a plant has prevented its construction.

TIENTSIN (*tē-ĕn'tsēn*), CHINA. Next to Shanghai, Tientsin is the chief port of northern China. It is the trade center of the province of Chihli, being situated at the junction of the Peiho, which connects it with the national capital, Peking, 70 miles to the northwest, and the Yuho or Grand Canal, which gives it water transportation to Hangchow and the Yangtze. Taku, about 45 miles southeast, at the mouth of the Haiho (the estuary of the Peiho), serves as the port for large ocean vessels. In winter-time when the rivers are frozen the ice-free harbor of Chinwangtao to the east serves as an auxiliary port. Tientsin carries on an enormous trade with the interior both by waterways and railways. There are extensive manufactures under both native and European management. Cotton yarn and cloth, soap, candles, brick, tile, cement, cigars, cigarettes, and leather are the chief products. Wool, cotton, hides and skins, bristles, strawbraid, peanuts, and vegetable oils are the leading exports.

In 1860 Tientsin was opened to foreign trade as a treaty port, and the principal European powers and Japan have since established concessions in the foreign settlement. After the Boxer Rebellion of 1900 the old city walls were pulled down, the streets were widened, and many radical improvements were undertaken, making Tientsin the model city of the Republic, with paved streets, tramways, electric light, telephone, and water and sewerage systems. Between 1870 and 1895 Tientsin was the headquarters of the famous diplomat, Li Hung-Chang, then viceroy of Chihli, and there he negotiated many important treaties with foreign representatives. Population, about 1,000,000.

TIGER. Upon the African continent the lion reigns supreme, sole monarch at least over his own feline race; but in Asia his sovereignty is disputed by a gaudily dressed cousin, the most formidable member of the cat tribe. Majestic as the lion appears when viewed full face, with his great bushy mane, he lacks the agile strength of his near relative. The tiger is larger, stronger, quicker, more graceful, and has great cunning. He is also the most perfect and beautiful of his race, owing to the bright coloring of his coat, his litheness, and graceful proportions. The stories of hunters conquering lions single-handed have no parallel in the history of the tiger; for no man, however well trained and armed, is a match for the tiger on foot. His terrible perfection has inspired the poem by William Blake beginning—

> Tiger, tiger, burning bright
> In the forests of the night,
> What immortal hand or eye
> Could frame thy fearful symmetry?

Asia is the home of the tiger. It is not found on any other continent. The Royal Bengal tiger of India is best known, but a larger, though less fierce, variety is found in Siberia. It has a much heavier and warmer coat of fur than its southern relative. The coat of the Bengal tiger has a ground color of tawny yellow with

THE TYRANT OF THE ASIATIC JUNGLE

No beast disputes the rule of the Royal Bengal Tiger of India. It is the fiercest of the cat family, and the largest and most powerful of all flesh-eating animals. Generally the Tiger lives in woods and dense thickets, where its black-striped tawny hide makes it almost invisible. By day it usually hides in the jungle, but at night it roams around in search of prey. Unlike the lions the Tigers are solitary beasts, preferring to wander alone. Here you see one of these master-cats and its victim, an antelope. The Tiger is not particular about his diet, but will prey on almost any living animal it happens to find.

black stripes on the body and limbs, the tail also being ringed with black. This coloring makes it very difficult to see a tiger in a thicket of reeds or dried grass. The largest tigers are about 11 feet from the nose to the tip of the tail and weigh about 500 pounds.

The chief difference between the tiger and the lion is in the coloring of their skin and the fact that the tiger has no mane. The skeletons of the two animals are almost identical. In habits also they are much alike, except that tigers, unlike lions, rarely hunt in pairs. Tigers are also good swimmers, which is unusual in the cat family, and if hard pressed will occasionally climb trees. They prefer to hunt at night by stalking their prey, but also prowl about in the daylight. They prey upon all varieties of wild animals and destroy a large number of cattle, horses, sheep, goats, and other domestic animals. A cattle-eating tiger will kill an ox about every five days, or from 60 to 70 a year. Unless it is cornered or greatly provoked the tiger avoids the elephant, and it rarely attacks a large buffalo or bear. In encounters with these animals the tiger is frequently worsted. It is said that when a tiger once tastes human blood it becomes a confirmed man-eater, preferring human flesh to all others. Man-eating tigers are greatly feared by the natives of India. One case is recorded in which a single tiger killed 127 persons in a single year. On an average 1,000 people are killed annually by tigers, mostly in India. The young tigers are far more destructive than the old ones.

In some respects the tiger is cowardly; it will eat carrion rather than attack a foe that is capable of making a successful defense. In its search for prey and its efforts to avoid hunters, it is cunning and bold. In its native wild state it is the most blood-thirsty of beasts, and in captivity it is treacherous.

Tiger kittens number from two to five in a litter, but more than two are rarely raised. The young remain with the mother till the third year, while she teaches them to hunt. Scientific name of Royal Bengal tiger, *Felis tigris*.

TIGRIS (*tī'grĭs*) **RIVER.** This great river of western Asia rises in the mountains of Kurdistan, south and west of Lake Van. It is joined at Til by the Bitlis, unites with its sister stream the Euphrates at Korna, and from this point to the Persian Gulf is known as the Shat-el-Arab. Its whole course is some 1,150 miles long. In its upper part it is a swift stream, and because of the tributaries which it receives from the east, its volume is greater than that of its companion stream the Euphrates. The Tigris in ancient times was the great river of Assyria and Babylonia. Nineveh, Seleucia, and Ctesiphon stood on its banks. Its chief cities now are Basra, Bagdad, Mosul, and Diarbekir. It is navigable for steamers at all seasons below Mosul. Germany's plans to control the fertile lands of Mesopotamia ("the land between the rivers"), which under irrigation can again be made enormously productive, was one of the contributing causes of the World War. (*See* Mesopotamia.)

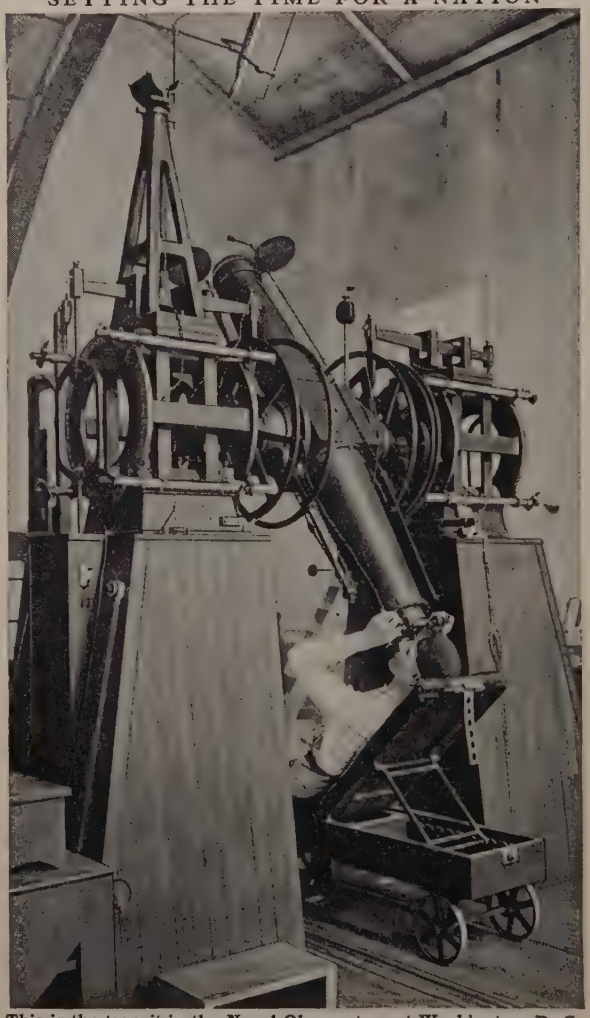
HOW *the* WORLD *Gets Its* TIME

Regulating Our Clocks and Watches by the Sun, Our Great Time-Keeper — Many Different Kinds of Time — The Imaginary Line Where Yesterday, Today, and Tomorrow Get All Mixed Up

TIME. For most purposes the world gets its time from the sun, reckoning a day as the average interval of time from noon to noon; that is, from the moment the sun reaches the meridian to the moment when the revolution of the earth brings the sun again into the same position. This is called "mean solar time." The time indicated by a sundial, called "apparent solar time," does not as a rule agree with this mean solar time, because the actual solar day is constantly changing in length owing to the shifting of the earth's position as it revolves around the sun.

Mean solar time, when determined by local observation, is obviously the same only for places on the same meridian or north or south line, because the sun travels 15 degrees of longitude (about 770 miles in the latitude of Chicago) every hour. Hence, if every place went by its own "local" time, the transcontinental traveler would have to change his watch one minute for every 13 miles or so, and railroad service would be greatly confused. So the United States and most European countries have established time zones approximately 15° wide, throughout each of which the same time is observed, so that the time of each belt will vary by an even hour from those on either side. These belts are measured east and west from Greenwich Observatory, England, so that the regions between 15° and 30° east of Greenwich set their clocks one hour ahead of Greenwich time ("central European time"), and those between 30° and 45° east are two hours ahead ("eastern European time").

SETTING THE TIME FOR A NATION

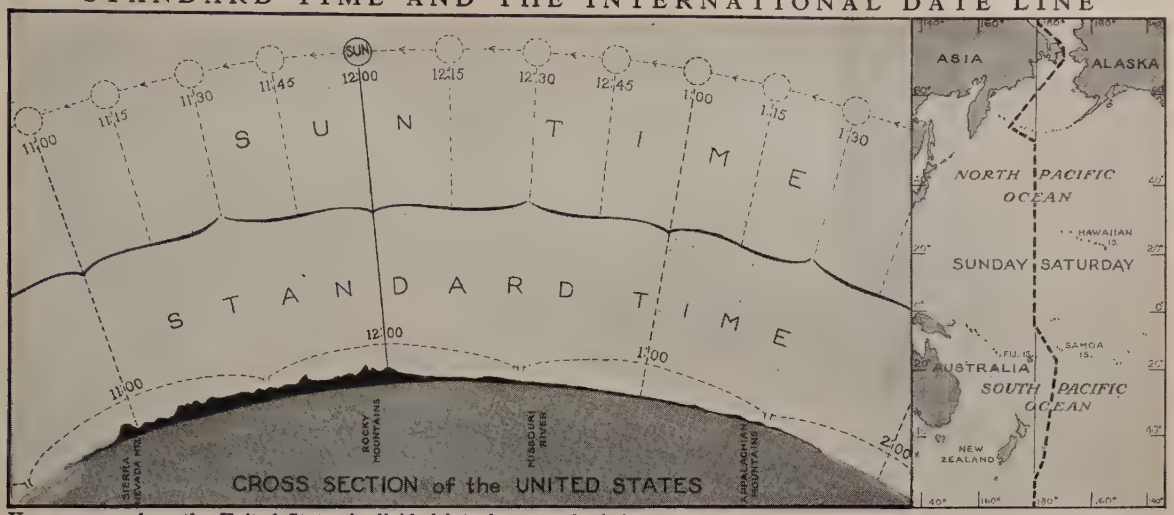


This is the transit in the Naval Observatory at Washington, D. C. A transit is a complicated telescope, so mounted that it enables the observer to tell when stars cross the meridian. From this observatory is sent forth each day exactly at noon a telegraphic signal which reaches the far corners of the United States. A clock, kept correct by observations of the stars, furnishes "noon" for this purpose.

"Standard time" for the United States (adopted in 1883) is reckoned in four zones—eastern, central, mountain, and Pacific. Eastern time is reckoned from the 75th meridian, which passes through Philadelphia, and so the time in all cities approximately within $7\frac{1}{2}°$ of the 75th meridian corresponds to Philadelphia mean local time. Since the 75th meridian is five times 15° west of Greenwich, eastern standard time is five hours slower than Greenwich time. Central time, reckoned from the 90th meridian, is one hour slower than eastern time and six hours slower than Greenwich time. This is approximately the mean local time of New Orleans and St. Louis. Mountain time, two hours slower than eastern time and seven hours slower than Greenwich time, is reckoned from the 105th meridian, which passes through Denver. Pacific time, three hours slower than eastern and eight hours slower than Greenwich time, is taken from the 120th meridian, which forms part of the eastern boundary of California. Standard time for Alaska is taken from the 150th meridian. The boundaries of all the time zones in the United States are considerably distorted, to suit the convenience of railroads, which can change their time only at terminal or division points. The same standard time zones prevail in Canada, with the addition of an Atlantic zone, calculated from the 60th meridian, for the extreme eastern part.

Throughout the eastern, central, and mountain zones clocks are regulated by signals sent out each

STANDARD TIME AND THE INTERNATIONAL DATE LINE



Here you see how the United States is divided into four standard time zones, represented by the dotted curves near the ground. Each of these zones uses as its "standard" time the sun time of the meridian which passes through its center. Thus, for example, the clocks all through the Mountain zone indicate 12 o'clock when it is precisely noon by "mean solar time" at Denver, though the actual mean solar time for various places in the zone ranges from 11:30 to 12:30. So all the places in each of the other zones observe the standard time of their central meridians, disregarding their actual sun time, shown by the dotted circles in the upper division of this diagram. The map at the right shows the International Date Line, that imaginary line through the Pacific where you can go from today to yesterday, as the text explains. Notice how it swerves from the 180th meridian to avoid cutting through the eastern tip of Asia and certain groups of islands.

noon from the Naval Observatory at Washington. Pacific time is sent out from the observatory at Mare Island Navy Yard, California.

By setting clocks at noon when it is really only 11 a. m. by standard time, sunrise and sunset can be made to come one hour later by the clock. This is known as "daylight saving" and has been adopted by many American cities (*see* Daylight Saving).

Where the Date Changes

Now suppose we follow the "time zone" system around the earth. When it is noon in Greenwich, England—Greenwich is used because it is the center of world-wide time—of say the 15th of April, it is only 7 a. m. in Washington. In San Francisco it is only 4 a. m., while in the time zone in which the Samoan Islands lie, it is midnight. That is, the 15th, which is half gone in Greenwich, has only commenced in Samoa.

If now we go east from Greenwich, when it is noon in the British Isles it is already 2 p. m. in Petrograd, 5:30 p. m. in Madras, India, and so on, until in the time zone marked by the Fiji Islands, just west of Samoa, the 15th would be within an hour of changing to the 16th. Thus, when it is noon at Greenwich, there is a line between Samoa and the Fiji Islands on one side of which the 15th of April would be just beginning, and on the other side it would be just ending.

That is why ships gain or lose a day when they sail around the world. Thus, suppose a ship is approaching Samoa from the Fiji Islands at 11:59 p. m. on the night of the 15th. Ten minutes later it "crosses the line"—and its time is now nine minutes after midnight on the *morning* of the 15th! That is, it has spent the 15th in sailing east toward Samoa—and now it has the 15th to use all over again!

If it were going west, it would lose a day. That is, just before crossing the line, it would be in the beginning of the 15th, while a few minutes later, after crossing the line, it would find itself in the early morning of the 16th.

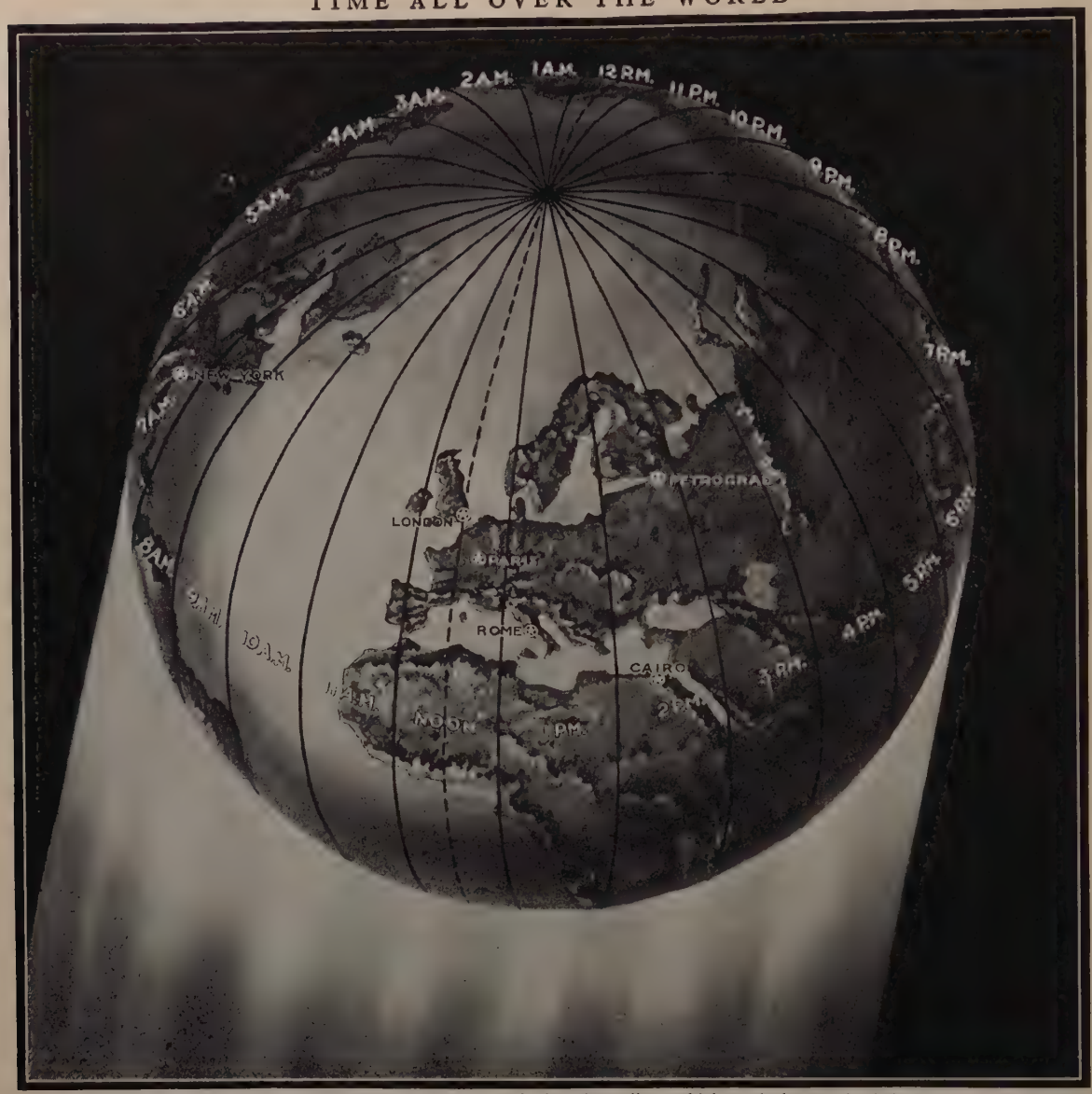
This imaginary line where the date changes in this way is called the "international date line." It was put in the Pacific Ocean, the other side of the world from Greenwich, where the change of date causes the least possible trouble. It deviates from the 180th meridian in various places, in order to avoid cutting through the land groups the meridian encounters.

Different Ways of Telling Time

The usual division of the day into "a. m." (ante meridian) and "p. m." (post meridian) groups of 12 hours each has given way for some purposes to the "24-hour" day in many countries. On the "24-hour" clock the hours begin with zero at midnight and run to 23; thus 1:30 p. m. is called 13:30 o'clock, and so on. This system is used in Spain and Italy and on the railway systems of Belgium and France. It was used by all the Allied military and naval forces in Europe during the World War.

On shipboard two varieties of time are used. "Greenwich time," or time corresponding to that at Greenwich, England, is kept by an accurate chronometer for use in determining the ship's position (*see* Latitude and Longitude). The ship's routine, however, is governed by "watches" and "bells." The day is divided into six "watches," commencing at noon, and each watch is divided into eight parts, marked by "bells." One-half an hour after a watch begins, "one bell" is struck. A half-hour later, or one hour after the commencement of the watch, "two bells" strike, and so on up to "eight bells,"

TIME ALL OVER THE WORLD



Here you can see how the world would look if you drew on it the imaginary lines which mark the standard time zones. All standard time is based on the time at standard meridians drawn 15 degrees apart beginning at the Greenwich Observatory near London, England. The picture shows the standard time all over the world when it is noon at Greenwich.

when the watch changes, and the bells strike all over again from one to eight. Under this system, noon, four p. m., eight p. m., midnight, and four a. m. are "eight bells," with the other hours and half-hours corresponding. "Clock time" is also kept on passenger liners and corrected every noon to allow for the ship's position. In the United States navy, as in the navies of most European nations, time is kept on the basis of standard time zones like those used on land.

Another method of calculating time, used by astronomers, is "sidereal time." The day of sidereal time is the period of one complete revolution of the earth upon its axis, and is determined by measuring the transit of fixed stars. The sidereal day contains 23 hours, 56 minutes, and 4 seconds of mean solar time, and begins at noon. (*See also* Calendar; Clocks and Watches; Day; Month; Week.)

Time, in music, means the division of a measure into the fractional parts of a whole note. It is usually indicated by a fraction, as $\frac{2}{3}$, $\frac{3}{4}$, placed immediately after the clef at the beginning of a piece or a movement. Common time ($\frac{4}{4}$) is sometimes indicated by C. In such fractions the lower number indicates the kind of notes to be used as time standards, while the upper figure shows how many make up a single bar.

THE VALUE OF TIME

OF ALL the natural gifts of life, time is the most precious, for upon time the use of other gifts depends. It is said that Queen Elizabeth, when she lay dying, offered her kingdom for a moment of time; but there was no wise man in all the land who could give her that. But you and I have thousands and millions of these moments, and we waste perhaps thousands of them.

There are people who are thrifty with money, who throw away golden moments as if they were of no value. Yet moments are golden things; for time, which we all share alike, whether we are kings or beggars or ordinary people, makes up our lives, and every bit of time we waste is a bit of wasted life. A moment is here, and then gone, forever.

We need not fear to be idle, for what we call an idle hour may sometimes be the best medicine we could take. It is not the hour that is properly idle that we shall ever come to regret; it is the hour upon hour, making day upon day, week upon week, of time given up to useless or even harmful amusements that we shall sigh for when sighing is in vain. Any one of us may look around and see two men we know, one with all the advantages of education, all the happiness of prosperity, all the influence of position; the other living a humdrum life without distinction of any kind. All over the world we can find people in pairs like this, and the whole of the difference between them lies in the way in which they use their time. It would be easy to go through a list of the world's great men, the men who have helped mankind along, and to show that they prized time more than anything else they possessed.

Long before you are old you will come to regret the time you wasted in your youth; but there is one thing you will never regret—you will never regret the time you gave to your books, and the attention you gave to your teacher. Men grow rich by using their money so that it brings them good interest, so that one dollar grows into two, and two into four; but nothing pays such good interest as the hours that a wise boy spends at school or with his books at home, and if there are any hours a man would like to call back again, they are those golden hours which you can call yours today, but which all too soon will be gone, never to return.

Use them well, for they are the hours in which you are making your name in the world. There was a man who saved a million lives. Before we were born he began to think about a great problem that was puzzling the doctors, and he had almost everyone against him. Hardly anybody believed in him. But he was in earnest, and he stuck to his work, and he went on thinking, thinking, thinking, until at last there came to him a great idea which has been a blessing to every suffering creature who has ever passed through an operation, and must have saved at least a million lives. And this splendid man, Joseph Lister, did this by saving his moments.

Thomas Carlyle, the great English writer, left only a few poems among the prose works that have made him famous; but one of these comes into our thoughts whenever we think of time. This is what it says:

So here hath been dawning
Another blue day;
Think, wilt thou let it
Slip useless away?

Out of Eternity
This new day is born
Into Eternity
A night doth return.

Behold it aforetime
No eyes ever did;
So soon it forever
From all eyes is hid.

Here hath been dawning
Another blue day;
Think, wilt thou let it
Slip useless away?

Think of a minute and all it may mean! You may make yourself immortal in it; you may give the world some great idea, invent some new thing, discover some great piece of knowledge, lift up some sad heart; or you may throw it away as if it were nothing, wasting this time which is the very gold of the world; or you may do even worse than that—you may use it meanly and ignobly, sowing the seed of misery and ruin through many lives. Time's hands scatter treasures generously for us all. We pick them up, or we leave, and according to our choice, so is our life.

Tin. The fact that tin does not rust makes it one of our most useful metals. It can also be beaten or pressed out into very thin sheets—one-thousandth part of an inch thick—and we often see it in the form of tinfoil, used as a moisture-proof wrapping, and in the collapsible tubes in which tooth-pastes are put up. Because it melts so easily it is also used in solder for welding objects together. Amalgamated with mercury it is used to "silver" cheap mirrors. It is softer than gold and silvery white in color.

Nearly half the total amount of tin used in the United States is employed for coating thin sheets of iron and steel from which tin cans and tin ware are made. Its value for this purpose lies in the fact that it resists most of the acids of foodstuffs. Large amounts are used for making alloys with other metals, especially in babbitt metal and similar alloys intended to reduce friction in bearings (*see* Friction). With copper it forms the alloy known as bronze. Its compound with chlorine, tin tetrachloride, a liquid, is used to dye silks and give weight to them, and was used during the World War of 1914–18 to produce dense smoke screens to protect attacking troops.

MALAY GIRLS "PANNING" TIN

In the Malay States, which furnish one-third of the world's tin supply, the metal is found for the most part in alluvial deposits. The simplest way of recovering the tin ore is by "panning" the "pay dirt," as these sturdy Malay girls are doing. Usually, however, the ore-bearing soil is washed in machines or run over sluices. Underground mining for tin is almost unknown.

Although the United States is the world's largest user of tin, it has to import practically all its supply. Alaska is the chief domestic source of supply, and the amounts obtained there have been negligible. One-third of the world's tin comes from the Federated Malay States, and the rest from Bolivia, Dutch East Indies, southern China, Nigeria, Great Britain (Cornwall), Australia (Tasmania), and South Africa. All of these sources except Bolivia are gradually producing less and less, and scientists fear that the world's known supply may soon be exhausted.

The chief ore of tin is tinstone, or dioxide of tin (SnO_2). The dressing of the ore is a laborious and delicate operation. It only yields from 10 to 84 pounds of tin-oxide to a ton of material, and the metal is so scattered through the rock in which it occurs that the ore has to be stamped to a fine powder. It is then repeatedly washed by machinery to get rid of impurities, is passed through a furnace to separate the sulphur and arsenic, and is then ready for smelting. Pure tin is often called "block" tin.

Men have used tin since very remote times. One period in man's history is known as the Bronze Age, to indicate the time when he melted copper and tin together to produce a hard metal which could be sharpened to a razor edge for his weapons and tools. The ancient Phoenicians used to make the long and hazardous voyage the entire length of the Mediterranean and north along the coast of Europe to England, to get supplies of tin from the mines of Cornwall.

Titian (*tĭsh'ăn*) (1477–1576). The old artist laid down his brush and gazed dreamily at the masterpiece before him in which he had just marvelously revealed the golden splendor of 16th-century Venetian life.

"I think," he said simply, "I am beginning to learn something about painting."

It was Titian who spoke—Titian, the great Venetian painter who at the age of 98 was still painting, and who during his long life of industry, success, and honor produced more than 600 pictures, glowing miracles of color, many of which today are numbered among the greatest art treasures of the world.

The great artist, whose Italian name was Tiziano Vecellio, was born at Cadore, in the Alpine region north of Venice. When just a little boy of ten he left his mountain home—where, legend tells us, he used to paint with juices extracted from flowers—and went to study painting in Venice. There he worked in the studios of Giovanni and Gentile Bellini, where the artist Giorgione was a fellow pupil.

Titian's pictures soon brought him fame, riches, fine friends, and many honors. In 1513 he became superintendent of government works, which office brought him a comfortable income. In return he was to complete certain great works begun by Bellini and paint the portraits of the Venetian doges or rulers, as they succeeded one another in office. He was a handsome man of courtly manners, who soon associated on terms of comparative equality with dukes and kings and princes of the church. His portraits of these famous men are among his greatest works. His first portrait of Charles V so pleased that great emperor that Titian was made a count and Knight of the Golden Spur, while Titian's children

were raised to the rank of nobles of the empire. Meanwhile the artist was producing many great works of religious and mythological subjects. Among the most famous of these are 'The Assumption of the Madonna', 'Christ and the Pharisee', 'Bacchus and Ariadne', 'The Entombment of Christ', 'The Supper of Emmaus', 'Venus Anadyomene'.

In 1530 at the death of his wife, Titian established himself in a beautiful new home on the sea at one end of Venice, where he was the center of a famous artistic and literary circle, joined even by kings. Here, at the age of 99, he fell a victim to the terrible plague which at that time killed 50,000 persons in Venice. He was buried with honors in the church of Santa Maria de' Frari.

Titian is looked upon as the greatest color artist of all time. In his fine portraits of emperors, queens, popes, doges, and fair women, his gorgeous church pictures glowing with exquisite harmonies of color, and his serene enchanting pagan deities amid their beautiful nature settings, he revealed the glittering pageantry of 16th-century Venice, that luxury-loving city of palaces, domes, and marble porticoes, dreaming in golden splendor beside the blue Adriatic.

'THE ASSUMPTION OF THE MADONNA'

This painting, now in Venice, is regarded as Titian's masterpiece. When Napoleon was carrying off art treasures from Italy to Paris, this picture was blackened over with candle smoke so that the French Commissioners would not consider it worth taking away; and so it remained in the possession of the land that gave it birth.

TITLARK. The pipit, as the American titlark is commonly called, is a "near-lark." In its plumage of streaked brown, as in its habit of singing on the wing and of nesting on the ground, it closely resembles the lark family.

Over 50 species of pipits, with the wagtails, make up the family *Motacillidae*, and occur in all parts of the world. Two species are common in the United States. The pipit, $6\frac{1}{2}$ inches long, is found in open country and wet fields. It feeds mainly on worms and insects. Its repeated call, *pipit, pipit,* has given its name. In the fields or prairies flocks of hundreds are often found running on the ground. (For illustration in color, *see* Birds.) Sprague's pipit, because of its lovely song while on the wing, has been given the name of "Missouri skylark." Scientific name of common American pipit, *Anthus rubescens.*

TITMOUSE. Orchard owners largely depend for a successful fruit crop on the help of the active little titmouse. When trees are bare and sprayers rest from their war against the insect menace, these little experts get in their best work. They search every crevice for hibernating insects, and the larvae and eggs from which harmful insects hatch. Then, when spring brings out the fruit blossoms, the wise titmouse knows which bud contains the harmful grub, and fruit growers have learned that these are the buds the birds destroy. So sprightly, bold, and inquisitive are they that one writer calls them "feathered interrogation points."

The plumage of the titmouse family (*Paridae*) is never spotted, barred, or streaked. Plain colors are the rule, generally gray, olive green, or brown above, and lighter shades underneath. Some species, notably the chickadees, have caps of contrasting color (*see* Chickadee). All have short cone-shaped bills. Some species are crested. Though classed as song birds, they are not necessarily singers, but all have cheery musical call-notes. As a rule they do not migrate, though they roam widely in search of food. They are found

throughout almost the whole world, most abundantly in the Northern Hemisphere. They nest in hollow trees or stumps. The eggs, six to eight in number, are white, slightly marked with reddish brown or rust color.

Of the 100 species, but 30 are found in America. Of these the tufted titmouse, commonly called tomtit, is a general favorite. This bird is six inches long, slate gray above, white and reddish beneath, with a pointed crest that adds to its pert appearance. It is found in the eastern United States, as far north and west as Nebraska, and south through the Gulf states. Tomtits line their nests with hair, and the saucy little birds go to all lengths to get it. One was once observed to obtain her lining from a red squirrel, stretched at length on a tree limb. She approached cautiously from behind and caught at the tail, till she had a mouthful of hairs, which she then carried to a nearby hole in a tree. Another instance is related of a titmouse alighting on the head of a man, seizing a beakful of hair, bracing herself on her stout little legs, and actually jerking out the lock.

LITTLE MR. TITMOUSE AND HIS CREST

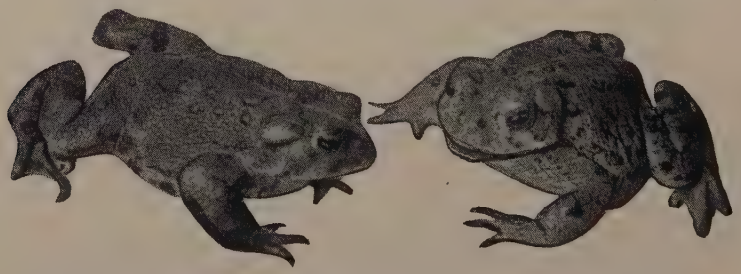
Not only do the varied notes and tones of the Titmouse express his changing moods, but his crest, which he is just now wearing pompadoured, rises and falls as this idea or that is passing through his little brain.

The bush-tit is but 4½ inches long, brown-drab above, brown-white beneath. Its nest, as remarkably large as the bird is small, is a gourd-shaped affair, from eight to ten inches long, made of leaves and moss, with a soft lining of spiders' webs and feathers. The entrance is from the side. These birds are found on the western slope of the coast mountains of Oregon to Lower California.

Of the Old World titmice the more common forms are the great titmouse and the crested titmouse of Europe, and the blue-capped titmouse of Asia. Scientific name of tufted titmouse, *Boeolophus bicolor;* of bush-tit, *Psaltriparus mimus.*

The BEAUTY *about Our* TOAD HELPERS

It's a Case of "Handsome is as Handsome Does"—How to Get into Toad Society—Mrs. Toad's Ideas about How to Take Care of Eggs—Toads as Pets—Why They are Worth Twenty Dollars Apiece



TOAD. Meet Mr. and Mrs. "American Toad," two of the most useful, interesting, and *beautiful* citizens! Let's hope this introduction has given you a favorable impression of them, for scarcely any other of our animal friends have been so misunderstood, maligned, and mistreated—and mostly because of an absurd belief that people get warts from toads. What nonsense! Of course, toads have warts, which form a harmful white fluid that protects them from their enemies.

Perhaps you know big fat good-natured Mrs. Toad, as she comes out on summer evenings to protect the flowers and vegetables of your yard and garden from cutworms and myriads of other injurious insects. But unless you have been a nature lover, you may not know much of her smaller husband or of the little toadlets or of the youngest babies when they are polliwogs in ponds. You must get acquainted with them also, for like so many forms of life, the youngsters of the toad family are even more interesting than the grown-ups.

We'll start by visiting a quiet pond or pool during the hot days of May or early June (April in the South). We shall know if it is the proper time and place by the loud singing of Mr. Toad and all his male friends. For, as in the case of birds and so many other ani-

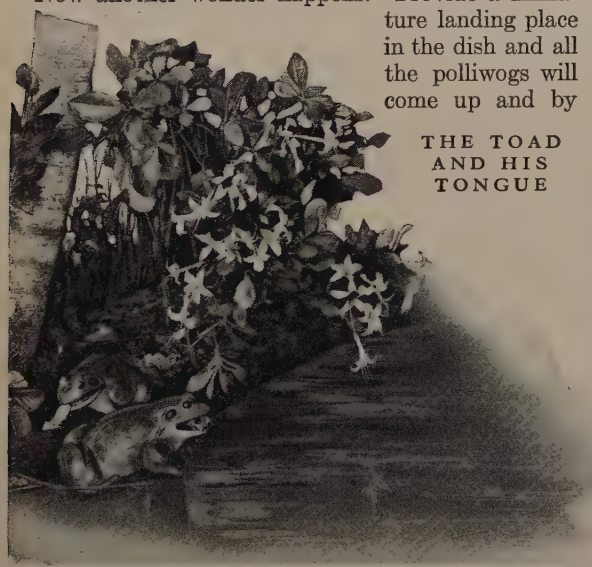
mals, the wives can't sing. Mr. Toad has left his usual home, and hopped and hopped till he has chanced to find a proper place for toads to lay their eggs. He is so overjoyed at finding this promised land that he shouts at the top of his voice to all the other toads near and far, "Here's the place to raise our families. Come on in, the water's fine!" And so, in a few days, to that place have hopped all of the grown toads of the neighborhood, perhaps dozens of them. Such a grand chorus they make, and such excitement, all about the matter of laying their eggs. Each Mr. Singing Toad you will easily locate when he sings, with his head out of the water and his throat all puffed out like a tiny toy balloon—his "vocal sac"—to several times the natural size of his head.

An Odd Way of Putting Up Eggs

After a few days of this excited singing, the mother toad lays her eggs in quiet water a few inches deep. Such quaint-looking eggs you've never seen! Two long cords of clear jelly, each 75 feet long and containing the small black eggs like strings of beads! Ten thousand of them in each cord, 20,000 in all, laid by one large mother toad! If you wish to see one wonder after another, take home a couple of inches of this jelly, with a few dozens of the eggs, and put them in a shallow dish full of pond water, with some pond mud on the bottom.

First, the spherical eggs hatch out into short stumpy polliwogs—in two or three days if the weather is warm, a week if it is cool. Add a bit of pond-scum from time to time for the polliwogs to feed upon, and in four to six weeks they will be an inch long and full-grown. Fishes they are in their real nature, just like frog polliwogs, only much smaller and blacker and foreordained to become toads instead of frogs.

Now another wonder happens. Provide a miniature landing place in the dish and all the polliwogs will come up and by degrees leave their fishlike existence. The long tail grows shorter till it is all absorbed; the lungs grow, to breathe air, and the gills are lost; the tiny arms and legs grow and become useful. And so with a hundred other changes, all in two or three days if the weather is warm, a week if it is cool.



THE TOAD AND HIS TONGUE

Life no doubt seems very pleasant to these two toads sitting by the pond and helping themselves to insects that come within striking distance of their remarkable tongues. A toad's tongue is fixed to the front of his mouth and has the back end free so that he can flip it over and capture a bug with its sticky surface with incredible speed and precision.

Now Master Toadlet, the size of a short grain of corn, says he is ready for his regular fare of mosquitoes and other insects. It is when the myriads of toadlets are leaving their childhood homes and hopping away in wet weather that we may see them by thousands, and many ignorant people formerly believed that they rained down from the skies!

Troubled Infancy of the Toadlets

Master Toadlet hides from his many enemies—snakes and crows and hawks and chickens and ducks—as best he can during the day. At night he comes out for his diet of insects, and to migrate farther and farther from the old home of his infancy. By fall he has grown so that his body is an inch long. Then he passes his first long winter sleep under the clods or stones. And so he does the next year and the next, till he is about three years old, when he makes his first trip back to the ponds for his first annual egg-laying. Each year this is repeated through a long life, perhaps 50 years or more. Of course the stories of toads being found in solid rocks and trees are absurd.

Keep a pet toad for some time; feed it angleworms and insects; and you will have a constant source of amusement and information. Look into its very beautiful eyes and listen to its sweet gentle voice, as it tells you all its confidences when you pet it; and I'm sure you too will say that a toad is beautiful. Make yourself a committee of one to protect all toads, not only for their sake, but also for selfish reasons, for it has been estimated that each big toad is worth as much as $20 as a garden protector!

Toads are found throughout the temperate climates of the world, except Australia. Perhaps 30 kinds are found in the United States, but most of them do not have a wide distribution. The so-called "horned toad" of the desert regions of the Southwest is not a toad at all, but a true lizard, and is related to snakes, turtles, and other reptiles. The common toad of North America is about three and one-half inches long, and is brownish-olive in color, usually with some darker spots, and with a yellowish streak down the middle of its back. The skin of a young toad is almost smooth, but as it grows older the warts become more and more prominent. The skin contains many glands, from which a milky secretion exudes when the animal is roughly handled. This secretion is harmless to man, but is poisonous to some animals which naturally prey on the toad.

Toads, along with frogs and salamanders, belong to the class of backboned animals known as *Amphibia*. Scientific name of the common widely distributed American toad, *Bufo americanus*. *Bufo lentiginosus* is also common in most of the Southern states.

The WIDE REALM *of* 'LADY NICOTINE'

A Gift of the New World, It Now Covers 5,000,000 Acres of the Earth's Richest Soil—How Sir Walter Raleigh's Servant Screamed for Help when He Saw His Master "Drinking Smoke"—Preparing the Leaf for Market

TOBACCO. A servant of Sir Walter Raleigh, so an old story tells us, one day saw clouds of smoke rising around his master's head. Startled at the sight, he dashed the contents of a tankard over Raleigh and ran screaming for help. This was the first time he had ever seen anyone smoking, for the use of tobacco, so common today, was unknown in Europe until the discovery of the New World.

The earliest explorers of America found the natives using the tobacco leaf for smoking, chewing, and even as snuff; and tobacco pipes have been found in prehistoric mounds. Often, as in the case of the pipe of peace of the North American Indians, its use was a sacred tribal custom. This strange Indian practice of "drinking smoke" appealed to the Europeans as one of the marvels of the New World. It was first a medicine, then a luxury, then the fashion as set by Sir Walter Raleigh.

From the time of its earliest use in Europe there was much opposition to it. James I of England published a bitter pamphlet against its use. Many believed that its effects were very harmful, even to adults, and on this point opinion is still divided, although the use of the "queen herb of the rude barbarian," as it is described in Chinese, has steadily increased until there is scarcely a people or tribe in existence which does not use tobacco.

The tobacco industry is of vast economic importance. Tobacco was long the chief export of the American colonies, and was the principal crop in several of them, even serving as currency. Today nearly 5,000,000 acres of the earth's richest soil are utilized annually for its production. The world's crop is more than 4,000,000,000 pounds every year. The United States produces more tobacco than any other country—nearly 25 per cent of the world's crop. In fact, Kentucky alone produces more than any foreign country except India and China. It is cultivated in many states, from southern Wisconsin to Louisiana and from Missouri to the Atlantic seaboard. The largest area of production extends from Kentucky to Maryland and from central Ohio to

RAISING TOBACCO UNDER CHEESE-CLOTH

The finer grades of tobacco are so delicate that they thrive better and develop a richer flavor when they are grown in the shade. Hence whole fields of tobacco are often grown under cheese-cloth tents, as in this picture. The expense of this method is more than repaid by the greatly increased value of the leaf and the increased production.

SUN-CURING IN SUNNY CALIFORNIA

The sun-curing of tobacco is but little practiced in the rest of the United States, but in sunny California this method is successfully employed, the wilted tobacco being suspended on racks.

North Carolina. Besides being the largest producer the United States also uses more tobacco than any other country and imports more. India ranks next after the United States, both in production and consumption. Other important producing countries are China, Russia, the Dutch East Indies, Japan, Germany, Turkey, France, Belgium, Italy, Greece, Hungary, Cuba, Porto Rico, the Philippines, Mexico, Brazil, and Canada.

Although all the varieties of tobacco came from two or three native American species, they differ greatly in size, thickness, and color of leaf, according to varying conditions of soil and climate. A field of tobacco is not so attractive as a coffee or tea plantation or a stretch of waving wheat or oats, for the plant is coarse and rank, with large drooping leaves on a thick central stem, gummy and clammy to the touch from the sticky secretion of the short hairs that cover the green parts of the plant. The large sweet-scented blossoms, which appear in a cluster at the top of the stalk, range in color from deep pink to nearly white. The buds are usually cut off before they open, to turn the nourishment of the plant entirely to the leaves. The black seeds are so very tiny that 60,000 of them make only one tablespoonful, enough to sow 100 square yards of seed bed.

Not only does the tobacco plant need great care, but it requires very careful fertilizing. Alternation of crops is almost a necessity. The soil of many sections of Maryland and Virginia was sadly depleted by successive plantings in the early days.

Tobacco will grow from tropical to north temperate climates, but various regions are specially adapted for growing certain types of tobacco, some for the making of cigars, others for "manufactured" tobacco —smoking and chewing tobacco, cigarettes, and snuff. Of the entire crop in the United States, 20 per cent is cigar leaf and 80 per cent "manufacturing" tobacco. The cigar leaf is produced in Wisconsin, Connecticut, Massachusetts, Pennsylvania, New York, Florida, and a part of Ohio. The manufacturing leaf is grown in Kentucky, North Carolina, Virginia, Tennessee, Maryland, and parts of Ohio. Bright flue-cured or yellow tobacco, grown in the Piedmont regions of the Southern states, is one of the most important varieties. It is used principally for making granulated smoking tobacco and plug tobacco. Connecticut and Florida supply a very fine leaf for cigar making, which is grown under artificial shade, cheesecloth being suspended on poles above the field. The White Burley tobacco of Kentucky and Ohio, a very light-colored leaf of mild flavor, is the most extensively cultivated tobacco in the United States. Perique, the strongest tobacco of all, is grown in small quantities in Louisiana.

The tobacco leaf of Cuba is world famous for its aroma and makes the finest of all cigars. The mild tobaccos of central and northern Europe are chiefly used in the pipe and the fine leaf of Sumatra is used in cigar-making. European Turkey grows a famous tobacco of peculiar aroma which is used in making fine Turkish and Egyptian cigarettes. The leaf is

small, about four inches long, and an inch and a half broad. In Japan big dark leaves are grown, which are used largely for cheap cigars. China sends a light-tissued flavorless leaf which is chiefly used to give a bright tint to other tobaccos. Indian tobaccos are used largely in cigar manufacture.

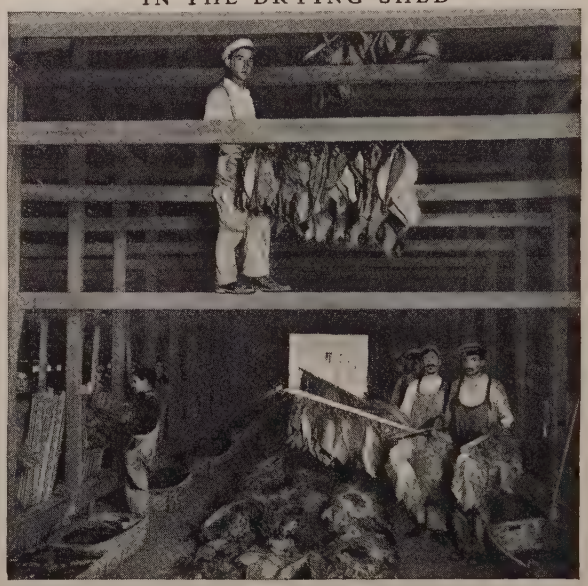
In France the production and manufacture of tobacco are under government supervision, and in Turkey and Japan they are a government monopoly. In nearly all countries tobacco is taxed and is a source of considerable revenue.

The tobacco leaf is green when harvested and does not have the characteristic color and flavor until it is cured, which includes drying, fermentation, and ageing. There are three methods of drying, or curing proper. Sometimes the leaves are sun-dried. This results in a very sweet chewing tobacco. The White Burley tobaccos as well as all cigar tobaccos are air-dried in barns and tobacco houses, so constructed that ventilation can be carefully regulated. The third method is by artificial heat—open fires or flues. The dark mottled brown leaves of parts of western Tennessee and Kentucky are cured over open fires. This gives them a characteristic smoky odor. In flue-curing, the fires are outside the sheds, and the heat is brought in by flues or iron pipes. This process results in the bright yellow leaf so largely used for pipe, cigarette, and chewing tobacco.

After drying, the leaf is brittle and cannot be handled without crushing to a powder, so it is left hanging until rainy weather, when the leaves absorb moisture enough to make it soft and pliable as a kid glove. Then the leaves are stripped from the stem, sorted, made up into small bunches, and fermented by piling in stacks five or six feet high. When fermentation is completed the tobacco is graded and packed. It is sometimes aged in a warehouse for four or five years, to make it more mellow.

Most cigars and a few of the most expensive brands of cigarettes are made by hand, but the less expensive cigarettes, as well as chewing and smoking tobacco and snuff, are made entirely by highly perfected machinery. Often the tobacco is flavored and given an artificial aroma with "sauces" made of sugar, licorice, spices, alcohol, etc.

IN THE DRYING SHED



The famous Connecticut leaf and most other American cigar tobaccos are cured in sheds like this, with many openings to permit free circulation of the air. Fires are kept going in the sheds during wet weather. In about six weeks the leaves are thoroughly cured, but they are so dry that they crumble at a touch. Hence they have to be left till moist weather occurs, when the leaves become soft and pliant so they can be stripped from the stems.

The principal manufacturing centers of tobacco products in the United States are St. Louis, Durham, Louisville, Jersey City, Richmond, Cincinnati, Chicago, Baltimore, New York, and New Orleans.

Tobacco owes its sedative and habit-forming powers to the drug nicotine, a deadly and dangerous poison. However opinions may differ as to the effect of tobacco on adults, all agree that it is very injurious to young people who have not attained their full physical development.

Scientific name of the principal tobacco of commerce, *Nicotiana tabacum*, a native of South America. This species supplies about all the cultivated varieties. The tobacco plant is a member of the nightshade family and is therefore a close relative of the belladonna or deadly nightshade, the tomato, the potato, and the jimson weed. The generic name *Nicotiana* was given in honor of Jean Nicot, French ambassador to Portugal, who in 1559 introduced the plant into France from Spain, where it had been brought from Mexico in the preceding year by Francisco Fernandes, a Spanish physician sent there by Philip II.

TOKYO (*tō'kē-ō*), JAPAN. Things new and old, oriental and occidental, jostle one another and vie for right of way in this capital and largest city of the Mikado's empire. The coolie pulls his rickshaw alongside the street car; horse and carriage, bicycle and automobile, pushcart and pack-laden human beast of burden contend for space in the crowded streets. Narrow winding roads emerge into wide paved boulevards, and three-story brick buildings stand next to one-story wooden shops. Overhead stretch networks of telephone, telegraph, and electric wires, while by the roadside run open drainage canals. Lofty chimneys and smokestacks of the new industrial Japan break the monotony of the rows upon rows of flat tiled roofs, but mar the beauty of the once smokeless city. The famous garden of the Mito palace is robbed of half its loveliness by the soot and din of the neighboring arsenal. The traveler may choose between fashionable European hotels and modest Japanese inns; and Buddhist and Shinto temples, Greek and Roman Catholic cathedrals, and Protestant churches of various denominations evidence the cosmopolitan character of the population. The principal shops display signs in English as well as Japanese, and on the streets one may hear spoken most of the languages of modern Europe.

Tokyo has corresponding variety in its diet, costume, and architecture. Foreign cooking is so popular with the Japanese that European restaurants are common. Native costume has not been abandoned, but for business purposes foreign dress has become commonplace, and the typical schoolboy uniform is of European cut. Japanese women in silk kimonas may often be seen accompanying their husbands clad in the height of London style and wearing high silk hats.

Architecture has been modified by the use of brick and stone, and in many Japanese homes of wealth are to be found all the comforts and luxuries of the West. But these are of course the exception. The great mass of people in Tokyo still live in one-story frame houses, with wooden shutters open by day to the breezes and shut up like boxes at night; the walls are often of paper, and usually there is no heating apparatus but a charcoal brazier. Twice a year in present-day Tokyo a general housecleaning is carried on under supervision of the police. Then every householder is compelled to wash and scour everything in his home, for cleanliness has become a national habit, acquired through fear of the deadly oriental plagues.

In a peculiar sense Tokyo is the heart of Japan. It draws to itself the nation's most eminent men of letters, statesmen, journalists, politicians, lawyers, and physicians. No ambitious Japanese student considers his preparation complete until he has spent some time in the lecture halls of the capital. There are to be found the famous Imperial University, and the two great private universities called Keiogijuku and Waseda. The government has its military and naval colleges there, also normal and technical schools too numerous to mention. The newly founded Christian college for women was naturally located in Tokyo, where the movement for the higher education of Japanese girls had its origin. Such advantages make Tokyo the chief educational center of the Far East.

A City of Modern Origin

Tokyo is of comparatively modern origin. In the 15th century it was a small fishing hamlet, known as Yedo. On the fall of the Shogunate, in 1868, the Mikado took up his residence in Yedo, and soon afterward changed the name to Tokyo, meaning "eastern capital" in contradistinction to the western capital of Kyoto. On a height in the very center of the city stands the imperial palace, a modern building half Japanese and half European in its style of architecture, surrounded by a double line of moats. The massive stone retaining walls are crowned with gnarled old pines that afforded excellent shelter in medieval times for archers defending the stronghold. The inner moat is a favorite haunt of wild sea-birds.

In the palace district are the principal foreign embassies, governmental buildings, and banks. This quarter and the great business districts to the east are crisscrossed by a network of canals emptying into the river Sumida. The most famous of the bridges across the Sumida is the Nihon-bashi (Bridge of Japan), the topographical center of the empire and the place from which all distances are measured. Foreigners take special interest in this bridge because it was here that in bygone days were posted notices prohibiting the practice of Christianity.

The city covers a vast area, so that even today, with all its modern buildings, it has lovely rural aspects. This is due to the large number of parks and gardens and the abundance of trees. During April the avenues of cherry trees in these parks transform the city into a veritable garden of pink bloom, and no other place or season affords so good an opportunity to see the beauty-loving Japanese in their happiest mood.

Little of the old Tokyo remains today. A long series of earthquakes and fires has destroyed most of the old temples and shrines with their treasures of ancient art. Most terrible of these disasters was the earthquake of Sept. 1, 1923, with its accompanying fire, which swept the greater part of the city and took scores of thousands of lives. Population, about 2,175,000.

Tole'do, Ohio. Rapid growth and prosperity have come naturally to Toledo, for few cities in the United States occupy a position of greater strategic importance in the competition for commerce. Situated near the mouth of the Maumee River at the western end of Lake Erie, Toledo enjoys the best of transportation facilities by rail and water, and commands a region thickly populated and rich in varied products. To the north and west lie the timber and mineral wealth of the Great Lakes region, the fruit orchards of Michigan, and the fertile plains of Indiana, while to the south and southeast lie the boundless resources of the great Ohio valley. Its position at the head of the direct lake route to the east makes it a great distributing point for the region southwest.

Toledo is perhaps the most important coal port on the Great Lakes, handling about half of the cargo coal carried by lake vessels. On its extensive wharves this coal from the mines of Ohio, Pennsylvania, and West Virginia meets the stream of iron and copper ore, grain, and lumber brought by water from the northwest. With these advantages it was inevitable that great industries should arise. Among the city's chief products are automobiles, metal wheels, refined petroleum, steel, bottles and fine glass, machinery, ships, beet sugar, wagons, and cotton goods. A pipe line brings petroleum directly from the mid-continental field, and natural gas for household purposes is piped from three fields.

The prosperity of Toledo is further reflected in the beauty of its many parks and playgrounds, its public buildings, and its residence sections. Noteworthy among the educational institutions is Toledo University, maintained by the city.

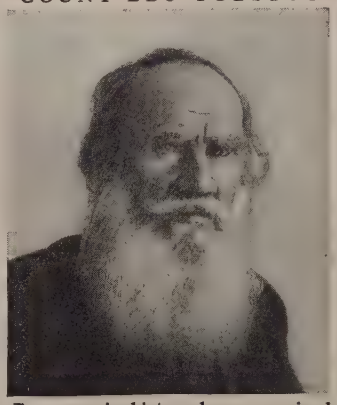
The government is a modification of the "federal plan," in which the mayor, the vice-mayor, and the ward councilmen only are elected by direct vote of

the people. The mayor appoints the "cabinet," consisting of the heads of the several departments of municipal work. The city became widely known for its successful efforts to emancipate itself from machine politics under two reform mayors—"Golden Rule" Jones, an idealist manufacturer, and Brand Whitlock, later known as the American ambassador to Belgium during the World War.

Toledo was founded in 1833 by the union of two earlier settlements on the Maumee, and named after the old Spanish city. The first great impetus for its growth came with the opening of the Wabash and Erie and the Miami and Erie canals, in 1843 and 1845, respectively. In the ten years from 1910 to 1920 the population increased from 168,000 to 245,000.

TOLSTOY (*tōl-stoi'*), COUNT LEO (1828–1910). Few men of modern times have had a greater influence on the world's thought than Tolstoy. His novels are models of power and realism; his social ideas sent out ripples to all parts of the world.

COUNT LEO TOLSTOY



Few men in history have exercised so profound an influence upon their native land as Tolstoy exercised upon Russia.

He was born in 1828, the fifth child in a noble family of Russia. In his book called 'Childhood' he gives the recollections of his life in the country, of learning to ride horseback, of trying to fly by jumping out of a second-story window. At school in Moscow he early gave promise. His tutor said, "That youngster has brains; he is a little Moliere." But the young Tolstoy had qualities which were greater than mere brains. Even in his early days he sought for truth through all sorts of speculation, and not only did he seek it, but he put it into practice.

Unluckily for his own peace of mind, however, Tolstoy had another side to his nature which was equally strong. He loved pleasures of all sorts: dancing, feasting, drinking, good company. In other words, he was like all the other young Russian nobles of his day, who were more or less dissipated. A visit to the Caucasus seems to have turned his thoughts to soberer things, and in 1852 he joined the army. The great amount of leisure drove him to write down some of the thoughts that tormented him for expression. 'Childhood' was the first of a series of stories which appeared within the following two years.

In 1854 Tolstoy entered the Crimean War as an officer. His experiences there gave him a great fund of material. The 'Sebastopol Sketches' exposes not the glory but the grim horror of war. His campaigns there gave him the basis for his story of Napoleon's invasion of Russia called 'War and Peace'. Various other novels, among them 'Anna Karénina', appeared at intervals during the years.

Although Tolstoy was acclaimed as a great writer, there were many reasons why fame did not satisfy him. Even in the earliest days he had tried to relieve the dreadful distress and poverty of the Russian peasants. He had taught in a school himself, he had tried to send a message to the world through his novels. But there the rigid censorship held him back. He had severed his connection with the orthodox Russian church because he did not think it expressed truly Christian teachings. Had it not been for the love and veneration in which the people held him, he would surely have been exiled for his liberal views and teachings.

In 1891 Tolstoy had crystallized his beliefs as follows: To be perfectly pure; to be perfectly free (not to take oaths); never to use violence for the protection of one's self or others, even against an animal; to do good to one's enemies. To carry out such a program of life would be impossible as society is constituted now. But Tolstoy with his accustomed fervor tried to put his beliefs into practice. He made shoes for a living, became as simple in his habits as a peasant, and divided his wealth among the members of his family.

During and before this period he wrote powerful articles setting forth his views. 'The Kingdom of God is Within You' was brought to America and England, where it was published. In Russia it was forbidden. He even simplified his art to the writing of fairy stories for children.

Tolstoy died in 1910, mourned by all the world. Many people did not agree with him and yet even to them he was an inspiration. He made plain the evils of the day. His writings are in large part a revelation of the soul of the Russia of the later 19th century. They reveal its idealism under a harsh exterior, its childlikeness, its depression and exaltation, its militant zeal coupled with a hatred of war and force, its care for human worth in the midst of a brutal and debasing autocracy. Tolstoy helps us to understand the nation which plunged in eight months from the rule of the czar to the dictatorship of the proletariat.

His chief works are 'Sebastopol' (1855); 'War and Peace' (1864); 'Anna Karénina' (1875); 'My Confession' (1882); 'The Kingdom of God is Within You' (1892); 'Resurrection' (1899).

TOMATO. In the old-fashioned gardens of our great-grandmothers there grew a bushy sprawling plant with brilliant scarlet pulpy fruit, much wrinkled and distinctly smaller than the tomatoes of today. These were called "love-apples," and if you had suggested eating one your great-grandmother would have held up her hands in horror; for the plant belongs to the same family as the deadly nightshade and it, too, was thought to be poisonous. It was not until well into the 19th century that this idea was proved false, and tomatoes began to be cultivated for their agreeable, slightly acid fruit.

Today the tomato is one of our menu-card favorites. It is a welcome ingredient in soups, may appear in any one of a dozen ways as a vegetable, is an almost indispensable ingredient in a meat relish, makes an excellent green pickle, and is at its best as a salad. A small, pear-shaped, yellow variety is made into a preserve which is relished by many.

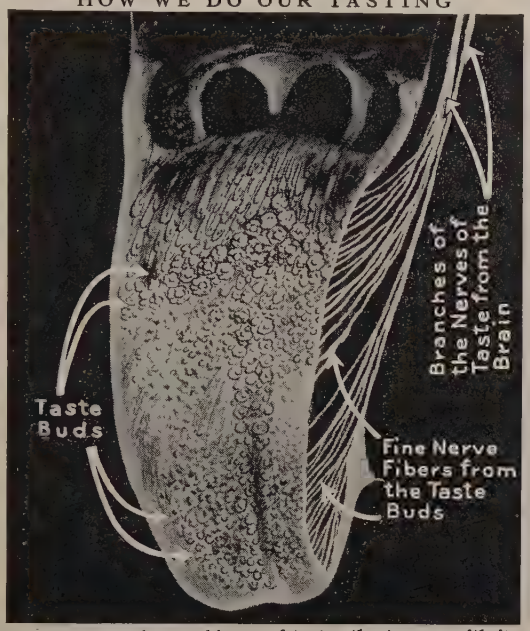
Tomatoes are now cultivated in all temperate regions of the world and they are canned in greater quantities than any other vegetables. They are also the basis of tomato catsup (or ketchup), chili sauce, and other relishes. A century of cultivation has given us a great smooth, thin-skinned, fleshy fruit, instead of the small seedy specimens of the old gardens. Some varieties now reach two or three pounds in weight. Some large kinds are yellow when ripe, but these do not ship well and are now rarely met with.

The tomato plant, like the potato, was originally found in South America. It is a bushy annual grown from seed. The plant has jagged leaves and small yellow bell-like flowers. The tender branches cannot support the modern heavy fruit and require staking. Oil pressed from tomato seeds is used in Italy for making soap. Scientific name of the tomato, *Lycopersicum esculentum.*

Tongue. Without tongues, we should not be able to speak, or chew our food, or taste it, or swallow it in the ordinary way. So it is easy to understand why that comparatively small organ which lies in our mouths has been called the most important of the muscles of our body over which we have control, for the heart, of course, is an involuntary muscle.

While nearly all animals have tongues of one kind or another, it is in the human being that this organ reaches its highest and most versatile development, for the articulation of words in speech requires the most active and pliable maneuvers—the tongue becoming in turn round or flat, long or short, curled up or extended, and shifting from one position to another with remarkable speed and accuracy. The tongue's importance as an organ of speech is evident when we consider the case of children who are born "tongue-tied," the tip of the tongue being fastened down and its movements so bridled that speech is made indistinct. Stuttering and stammering also are caused in part by inability to control the movements of the tongue through the nerves and muscles.

HOW WE DO OUR TASTING



Here you see the machinery of taste; the tongue with its taste buds and the nerve fibers from these buds which connect with the nerves of taste running up into the brain. It seems odd—doesn't it?—that while the tongue does the tasting, it hasn't an idea how things taste until the taste center in the brain says, "This is sweet or this is sour," "This is bad, spit it out!"

The sense of taste depends on certain little projections called "taste buds" located on the top, sides, and back of the tongue (*see* Taste). The tip of the tongue has more endings for sweet, and therefore we can taste sweet things better at the tip. The back of the tongue is better developed for bitter. A good many substances have a combination taste. Epsom salts is bitter and salty at the same time. Many others have little or no taste but an odor which we chiefly recognize when we get them in the mouth. Hence we confuse smell and taste. If you take some dry ground coffee in the mouth while holding the nose, you will be surprised how little taste it has. Now let the air pass back and forth through the nasal passages and the flavor of coffee instantly appears. From this experiment you get an explanation of why many things lose their "taste" when we have a cold. It isn't the taste, but the smell that is gone.

The delicacy of taste varies for different substances. One part of sugar in 200 of water can just be detected; while one part of quinine in 200,000 of water can be distinctly tasted.

Taste is useful in making a choice of foods. Among animals it is the best guide. But man lives under artificial conditions, and often the sense of taste is cultivated abnormally. Some people take only things they like to eat. People have actually died while surrounded with plenty, because they did not choose the foods their bodies needed. Children should learn to eat a considerable variety of foods, as only thereby can the body get all the substances it needs. (*See* Food.)

Among the lower animals are found many curious tongue forms. The members of the cat family, for instance, have bristle-like projections on their tongues for rasping the flesh from bones; grass-eating animals have long tough tongues for gathering the grass into bunches before they bite it off; woodpeckers are equipped with slender barbed darts with which they impale the worms they have dug out with their beaks; toads and chameleons have long sticky tongues fastened to the front of their mouths, which they flip out and draw back with their insect prey glued fast. Queerest of all, perhaps, are the forked tongues of snakes, which some scientists believe to be the organs of a sort of sixth sense (*see* Snakes).

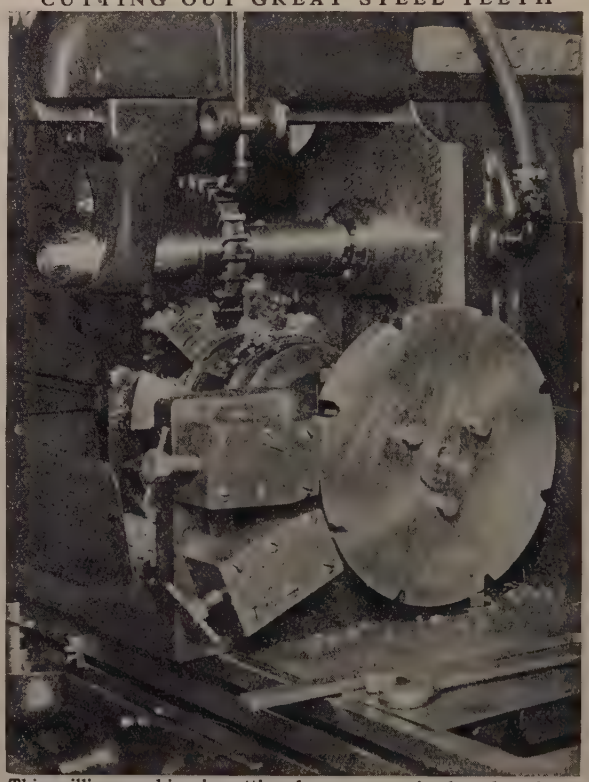
TOOLS—*The* BUILDERS *of* CIVILIZATION

How Men Have Taken Lifeless Stone and Wood and Metal and Put Them to Work—Giant Devices that Pound and Stamp and Bore and Cut and Shave—The Ingenious Labors of the Lathe Family

TOOLS. When man first pounded an object with a rock to crush or flatten it, he may be said to have used a tool for the first time. From that time on, much of his progress has been a story of tool-using—so much so that man can be set aside from all other members of creation as "the tool-using animal," and his material progress can be gauged by the advance from the first stone hammer to the ponderous 200-ton lathe which bores out 16-inch naval cannon.

The origin of hand tools, of which even our most complex machine tools are but developments, is lost in antiquity. These hand tools may be grouped into the families of the hammer, chisel (including planes), saw, drill, scissors, grinders, punches, and molding implements. Also the beginnings of machine tools—tools operated by mechanism instead of by hand—appeared in bygone ages; but the real development of machine tools commenced with the appearance of the steam engine. Then for the first time power in abundance could be applied, and no task, however complicated and ponderous, was too much for tool-makers and designers to attack.

CUTTING OUT GREAT STEEL TEETH



This milling machine is cutting deep grooves in the edge of that great circular block of metal you see fixed beneath the shaft. The cutting is done by the chisel-like blades on the rim of the revolving wheel mounted on the upper shaft. So delicately can this ponderous machine be adjusted that it will shave off a sheet of metal two one-thousandths of an inch thick.

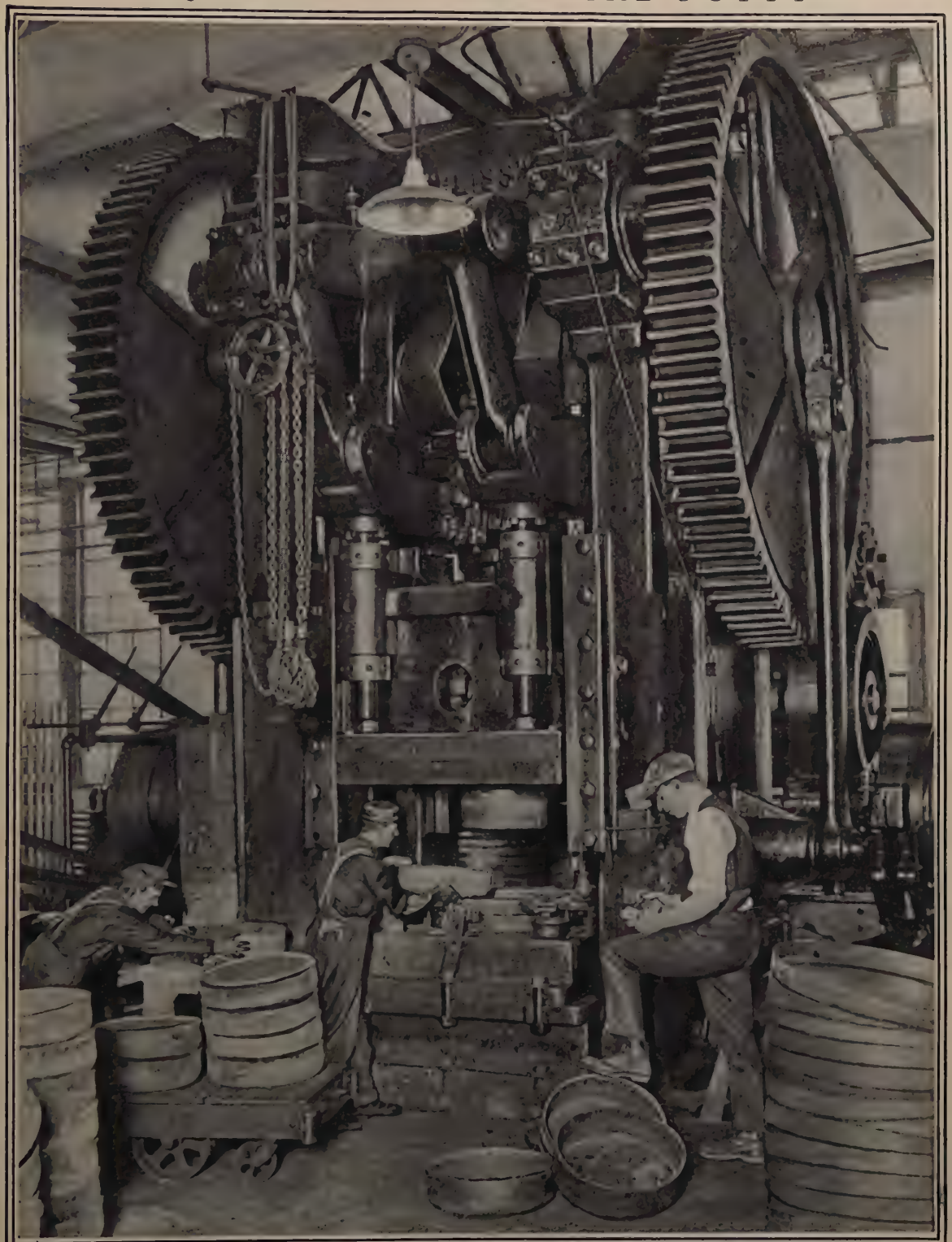
Perhaps the leading example of human ingenuity in machine tools is the lathe. In this machine the material to be worked is held firmly between two plates or points, and turned about a horizontal axis. An upright chisel or other cutting tool is held against one side of it, and cuts it down to cylindrical form as it revolves. By setting the chisel farther toward the center of the material, the cylinder can be reduced in diameter, or by setting its cutting edge at an angle with the axis of rotation, a sloping or conical surface may be cut. In modern lathes, these settings can be changed automatically as the work progresses. Lathes are made in all sizes, from tiny bench lathes used in jewelry shops to huge gun-turning machines. Sometimes the object to be turned is set upright instead of horizontal, to make it easier to set the material in position. Such lathes are said to be of the vertical type. The lathe principle is also used in special machines known as screw-cutting machines, which produce the threads on screws. Bolts and pipes may also be threaded by means of a block of metal which has threads cut inside a hole through it. The material to be threaded is rotated inside this hole.

Next to the lathe comes the great family of borers, drills, and reamers. In a boring or drill machine the material is held firm against a plate or rest and the tool works into it with a rotary motion from the other side. In the case of a drill the material usually is solid and the tool must cut the entire hole. In the case of a reamer, the hole has been made with a punch or when the material was put together in rough form, and the reaming tool works around the inside of the hole to smooth it and finish it to exactly the size desired. In many drill presses several drills are mounted in the desired position, and all of them advance into the work at once.

Planers contain a broad chisel-like cutting tool, so set that it shaves off the surface layer of material, leaving a smooth finish. Usually the tool is held fixed and the material is moved past it by the mechanism. If the cutting blade is narrow, however, instead of smoothing the entire surface it will cut a slot or groove; machines of this sort are known as "slotters." By varying the shape of the cutting tool, the groove is cut in any shape desired, square, V-shaped, or otherwise.

Instead of a chisel-like tool, finishing and slotting machines may use a rotating cylinder equipped with cutting edges about its sides. When the material passes this cylinder, its cutting edges either smooth

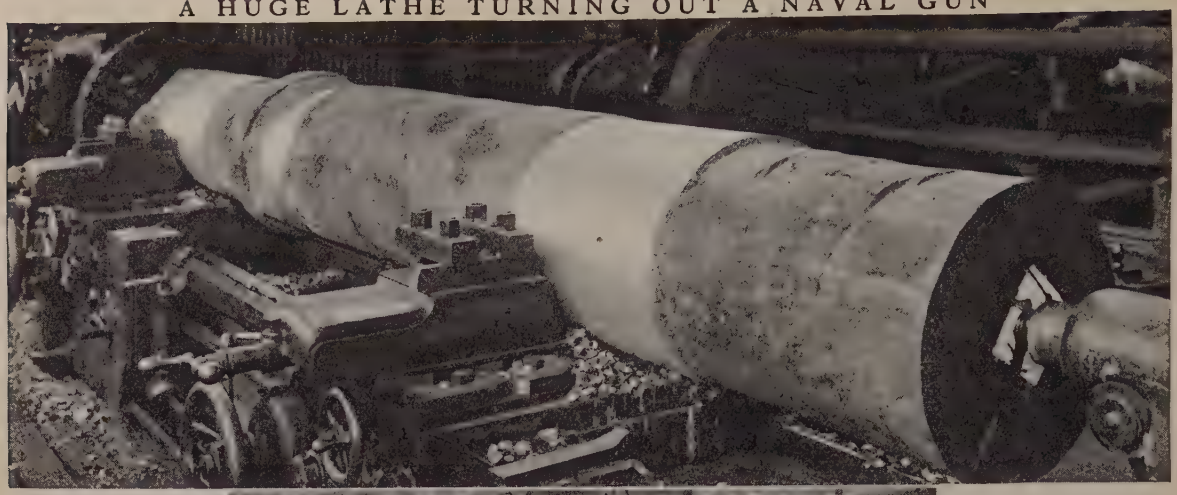
SQUEEZING STEEL LIKE PUTTY

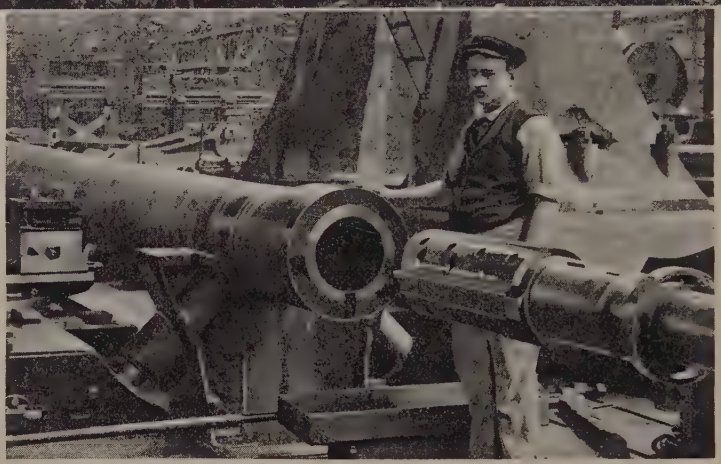


This giant press is engaged in stamping out the drums upon which automobile brakes operate. The rough metal blank is put under that massive column of steel called the "plunger," the great cogged wheels revolve, driving that immense toggle joint, and the plunger descends, squeezing the blank into shape as if it were made of tissue paper. Nearly all metal dishes and pans are stamped out in a similar way. Presses of this kind can be adjusted so finely that they will drive a cork home in a bottle without even scratching the glass. Toggle joints are among the most powerful of mechanical devices. Their action depends upon the bending or straightening of their knuckles. The simplest example is found in the device which thrusts out the ribs of an umbrella.

contained in the Easy Reference Fact-Index at the end of this work

A HUGE LATHE TURNING OUT A NAVAL GUN





In the upper picture we see the rough gun casting delicately centered in the lathe and revolving slowly while powerful milling chisels shave down the outer surface to make it smooth and uniform. Below we see the gun supported on the lathe bed, while the great boring tool is about to be thrust down the muzzle to ream out the interior. Later, an even more delicate and complicated tool will cut out the rifling grooves in the barrel.

the surface or produce a groove, according to the length of the cylinder. Machines that perform this type of work are known as "milling machines."

Some saws are reciprocating—that is, they move back and forth, like the hand saw—but most of them are either circular or of the "band" type. A circular saw is a disk with teeth around the edge, and the work is pressed against the disk. A band saw is like a huge flexible hoop, drawn out so that it is straight except where it passes over driving drums at two points, and the work is pressed against one of the straight portions. Heavy material is carried by moving supports.

Shears work much like hand scissors, except that the cutting blades are not riveted together, thus closing at an angle, but are pressed against the material throughout their entire length. They vary in size from machines which cut tin-plate to the great instruments that slice up huge steel billets. Punches press a tool against the material and force it through, thus producing the desired hole.

Presses resemble punches, except that instead of forcing a tool through material, they force a mold, usually called a die, upon it and make the material take the shape of the mold. Sometimes they carry a cutting edge around the mold, and first cut the desired piece of material from a sheet, and then by continuing the stroke, mold it to the desired shape. Material may also be shaped by hammers, which either strike successive blows or exert continuous pressure. Modern hammers are built so accurately that one may be set to exert just enough pressure to crack an egg-shell or to flatten under its blows a heavy bar of steel, as the operator desires.

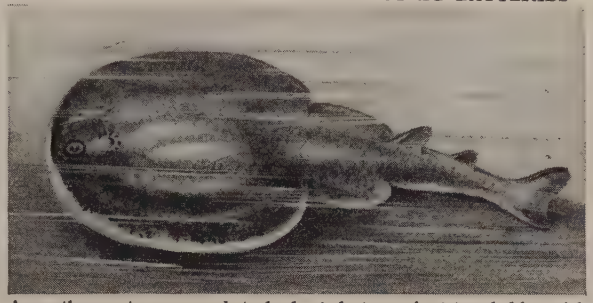
Metal-working machines must be heavier, and must work more slowly than corresponding wood-working types, and the actual "tool" must be somewhat different in shape. In a wood-cutting chisel, for example, the angle between the two faces of the cutting edge may be very slight—a few degrees only—so that the edge is long and fine. Such an edge applied to metal, however, would wear away almost instantly, and the angle between the two faces must be large—from 30° to 60°—so that the edge will have ample support and will last for several hours without regrinding. In general principles, however, machines of both sorts are the same.

Toronto, Ontario. On account of its eventful history, the character of its inhabitants, its position as the capital and chief city of the province of Ontario, and its prominence in the educational and industrial life of Canada, Toronto is one of the most representative cities of the Dominion.

It is the second city in size and importance in the country, ranking next to Montreal, but while Montreal is largely French, Toronto is the most ultra-British

city on earth. The number of Union Jacks that flutter over it on patriotic occasions is a surprise to the visitor, and in the World War, enthusiasm for the cause of the Allies was nowhere more ardent than in Toronto. A considerable proportion of its residents claim descent from the United Empire Loyalists who were driven from the northern colonies during the American Revolution. These people naturally entertained no love for their old neighbors, and in the War of 1812 they fought valiantly when the Americans attempted to seize Canada. During the war, their town, then known as "York," or in bad weather as "Muddy York," was burned. On the ashes, however, there arose one of the trimmest, cleanest cities on the continent. The city was incorporated in 1834.

THE TORPEDO-FISH AND HIS ELECTRIC BATTERIES



A gentle creature enough to look at, but you just touch him with your foot while swimming in southern waters and see what a shock you'll get! He's a Marbled Electric Ray Torpedo, and like the rest of the Torpedo-Fish family, has a system of electric storage cells on each side of his body near the head; and he's all "wired," too, ready for business!

Toronto is a city of distances. The streets are long, broad, and tree-lined when you get beyond the business center. Among the many beautiful buildings are colleges, government buildings, and churches. The University of Toronto in Queen's Park is one of the leading universities of Canada. Near it are two other colleges—McMaster and Victoria—both occupying large and stately buildings. Trinity College, formerly an independent university, is now also affiliated with the University of Toronto.

But Toronto is more than a city of beautiful buildings; it is a large industrial and commercial center. In it flourish hundreds of industries, from the manufacture of agricultural implements to the making of soap. Machinery, ships, leather, wood products, clothing, and automobiles are some of the many other varied products. Manufacturing is promoted by the cheap electric power obtained from Niagara Falls, 83 miles distant. It is also an important distributing point. With a fine harbor on Lake Ontario, it can ship goods by water or by rail. It has a large lake commerce in lumber, grain, coal, cattle, and fruit. Population, more than 525,000.

TORPEDO-FISH. Sometimes an ocean fisherman reaching into his net will get a shock that almost paralyzes his arm. He has been "torpedoed" by a strange monster that looks and acts something like a bomb with a fat fuse attached to it. This fish is a living electric battery. He can turn on his own current whenever he pleases, and the shock he delivers when excited is powerful enough to make the fisherman uncomfortable for hours.

The torpedo-fish, which belongs to the general family of skates and rays, is actually equipped with a system of electric storage cells, situated on each side of his big circular body, near the head. These cells consist of a group of prism-shaped compartments of muscular fiber, running perpendicularly through the body of the fish. The upper side of the torpedo is the positive pole of the battery, the lower side the negative. When he is out of water, the torpedo must be touched at two distinct points before the circuit is complete and the shock received. But in the water, which is an excellent conductor of electricity, only one point of contact is necessary.

This "shocking" apparatus is not only used by the torpedo-fish to defend itself, but to stun and kill the smaller animals on which it feeds. If it were not for this, he would probably starve to death, for he cannot move very fast, nor are his teeth and small mouth suited for catching or biting his prey. So he lies on the bottom until some creature comes near enough to be "electrocuted." Swimmers in southern waters occasionally strike one of these creatures with their feet, and many mysterious cases of drowning are attributed to the crippling effect of such electric shocks.

The torpedo-fish is round and flat, with a stout tapering tail to which the fins are attached. His body is smooth and soft to the touch. The largest species is found on the Atlantic coast from Cape Cod south, some of them reaching four feet in length and weighing nearly 200 pounds. When a torpedo-fish is weak or dying, his electric powers gradually disappear.

Several species of fish, notably the electric eel of South America, have the same strange faculty of generating electricity.

Scientific name of torpedo-fish, *Tetronarce occidentalis;* electric eel, *Electrophorus electricus.* The electric eel is remarkable for the great size of its electric organs, which are located in the tail. It can discharge enough electricity to kill an animal of considerable size, and is said to possess enough power to knock down and benumb a man. When the eel has made frequent use of this faculty its electric power becomes impaired and a long rest is necessary before it is regained. The natives take advantage of this fact in capturing the fish by driving large numbers of horses into streams where they abound. When the fish have exhausted their electricity by repeated attacks on the horses they are easily taken.

TORPEDOES AND MINES. During the World War of 1914–18, hundreds of vessels, including neutrals, were sunk, with human lives and fortunes in cargo, by means of submarine-fired torpedoes and submarine mines, which are among the most ingenious and destructive weapons of naval warfare. They are explosive devices designed to blow a hole in a ship at or below the water line. They consist essentially of a charge of guncotton or TNT (*see* Explosives), the mechanism or fuse which ignites

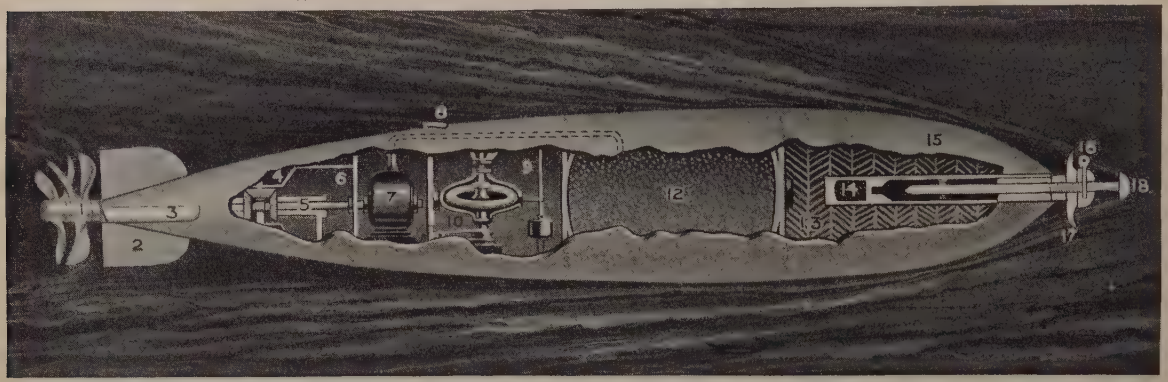
this charge, and the water-tight steel case shaped to plow easily through the water.

The modern naval torpedo, which may cost as much as $8,000, is cigar-shaped, and is propelled or shot from the metal torpedo tubes in the structure of submarine boats, torpedo boats, and occasionally torpedo boat destroyers (*see* Navy; Submarine). Since the perfection of the submarine, the torpedo is fired almost always below the surface of the water.

The maximum effective range of a torpedo is about 4½ miles, but submarines seldom fire at a ship more than a mile distant, because of the small chance of scoring a hit.

As early as 1585, again in 1730, and during the American Revolution and following years various crude torpedoes and mines were developed; but it was not until the Civil War that such devices came to the front as serious weapons. They were then widely

HOW THE DEADLY TORPEDO IS MADE



1, Twin propeller screws; 2, vertical rudder; 3, horizontal rudder; 4, bevel gear; 5, propeller shaft; 6, buoyancy chamber; 7, starting gear, the engines of which are set off automatically as the torpedo leaves the tube; 8, starting pin; 9, engine chamber; 10, balance chamber; 11, gyroscope; 12, a weight which controls the depth of running by acting on the horizontal rudder; 13, compressed air chamber; 14, war-head; 15, gun-cotton charge; 16, primer of fulminate of mercury; 17, striker, which, driven in, fires the charge; 18, safety-in, withdrawn at the moment of firing.

The Whitehead "automobile" or "fish" torpedo, or a modification of it, is used almost exclusively in all navies of the world. The case or shell is from 18 to 22 inches in diameter and from 16 to 22 feet long. On the outside, in the rear, like the tail of a fish, are the propellers or rudders. The case is divided into three main chambers. The section nearest the propellers contains the engine for driving the torpedo, and the vertical and horizontal steering gear, which is equipped with a gyroscope for holding the torpedo to its course (*see* Gyroscope). The middle compartment contains highly compressed air for driving the engine, etc. The front compartment is the conical-shaped head, containing the explosive—250 pounds or more. Projecting from the head is the "war nose," which carries a firing pin and releasing screw.

How the Torpedo is Fired

How is a torpedo fired? Sailors slide the heavy torpedo into the boat's torpedo tube, closing the inside door of the tube and opening the outside or sea door at the opposite end of the tube. A valve is opened by electricity, and with a terrific "Swish!" the torpedo is shot out by compressed air.

It comes at once under its own control. As the torpedo darts through the water at 30 to 50 miles an hour the releasing screw is unscrewed by its own revolving blades until the firing pin is unlocked. Then when the torpedo strikes the enemy ship with its war nose, the firing pin is driven in and explodes the charge. For practice, however, a "dummy head," without explosive, is employed.

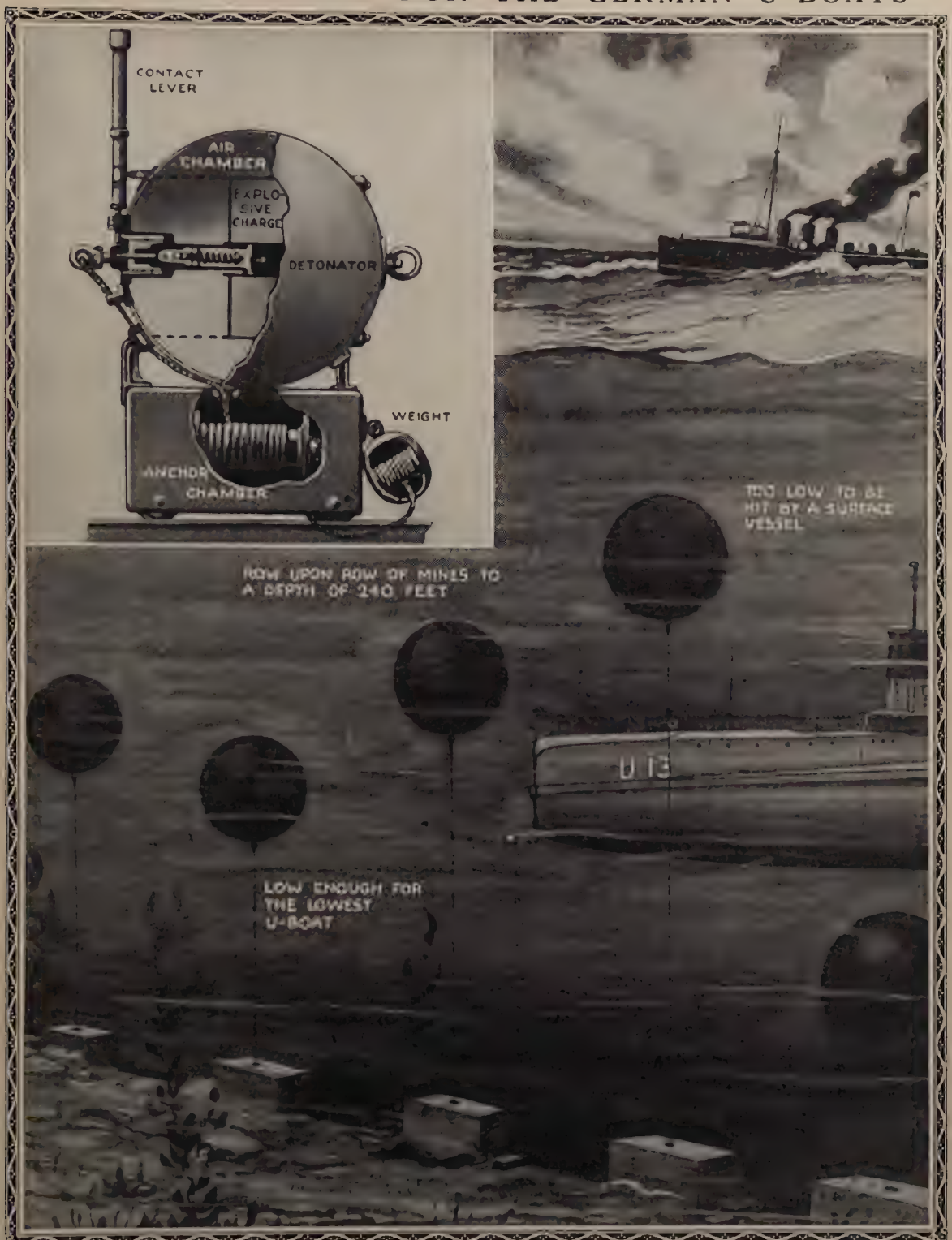
and successfully used for blockading channels and destroying ships, particularly by the Confederates. Until long after the Civil War they were all known simply as "torpedoes." Whitehead, an Englishman, brought out his celebrated invention in 1868. Improvements on the Whitehead torpedo have since been continuous. An American invention of 1915 is considered particularly promising. It is designed to carry its own power and to be steered by electricity from shore or a vessel.

Seas Sown with Death

Submarine torpedoes were used indiscriminately by the Germans in the World War, but both belligerents strewed the seas with mines. Indeed, for years after the war a vessel occasionally would run into a derelict mine overlooked in the great mine-sweeping operations following the armistice.

The greatest mine planting operation in history was the laying of the famous North Sea mine barrage in June–October 1917, by a United States mine-laying squadron of ten vessels, each capable of carrying 4,000 to 5,500 mines, aided by four British boats. This was an underwater path of anchored mines stretching from the Orkneys to Norway, 230 miles long and an average of 25 miles wide, containing 70,100 mines, which alone cost more than $30,000,000. Six to ten separate lines of mines were laid on or near the surface; there were other lines still deeper, and a third layer deeper yet, so that a submarine could scarcely escape, however deep she might voyage. It was this deadly barrier or blockade which did so much

THE GREAT TRAP FOR THE GERMAN U-BOATS



Here you see how the United States Navy during the World War laid its famous mine barrage between Scotland and Norway in the North Sea and so bottled up the German submarines. In the upper corner the mechanism of one of these submarine mines is shown. The explosive occupies the whole of the central chamber, while the air chambers are just large enough to make the mine globe lighter than water. Before the mine is dropped, the cable is adjusted to the length desired. As the anchor chamber strikes bottom, it releases the cable drum, and the mine globe mounts again to the length of its tether. The contact lever is so adjusted that when a ship strikes the mine, the explosive is set off.

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toward destroying or "bottling up" German submarines while the "Yanks" were being transported across the Atlantic.

Mines are usually globe-shaped, about three feet in diameter. They are anchored either on the bottom (in shallow water) and called *ground mines*, or anchored so as to float at from 5 to 20 feet below the surface of the water. Ground mines often connect by wire with a "contact" or firing device floating at 5 to 20 feet below the surface. Unanchored or drifting mines were much used in the narrow Dardanelles straits during the war.

Self-acting mines are fired either mechanically or electrically, usually by means of small levers protruding from the mine case or contact piece. Struck by a vessel, these set off the charge either by driving a firing pin, or by completing an electric circuit.

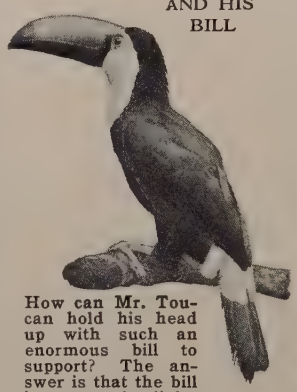
Controlled mines have wires leading to mine stations ashore, and are fired either automatically or by an observer on shore.

Ships are perhaps best protected from mines by the *paravane*, a ship's "fender," an English invention of the World War. It consists essentially of a pair of big cigar-shaped steel "otters," connected by a cable 150 feet or so long, each otter bearing knives in front. The middle of the cable is attached under water to the bow of the ship. When the moorings of a mine are caught by either half of the cable they are forced along to the otter and cut by the knives; the mine then rises to the surface and is easily destroyed. Of about 5,000 British and American ships equipped with paravanes during the war, none was destroyed by a mine.

The removal of mines, always a dangerous undertaking, is effected by mine sweeping or countermining. Sweeping or dragging is most expeditiously performed by two vessels, preferably steam trawlers. These steam abreast each other a few hundred feet apart dragging a heavily weighted cable, each ship having an end of the cable aboard, and the bight or sagging part of the cable sliding along behind, below the water surface. Mines are gathered in the bight and are then exploded by gunfire or otherwise. Countermining is the explosion of mines in a suspected area by means of other mines.

TORTOISE (*tôr'tis*). Land turtles are often called "tortoises," and the name is at times given also to certain fresh-water turtles such as the terrapin, which are frequently called "marsh tortoises." The name comes from the Latin *tortus*, "twisted," referring to the creature's crooked feet. Zoölogically there is little difference between turtles and tortoises, both belonging to the order *Chelonia* of the Reptiles. The tortoise-shell of commerce is produced not by the tortoise but by sea turtles, usually the hawksbill. It has the remarkable quality of becoming soft and pliable when subjected to a heat equal to that of boiling water and of retaining when cold any shape which has been given it while soft. Pieces can also be welded together by the pressure of hot irons. Tortoise shell is used chiefly for combs for the hair but is much used also for inlay work in furniture and ornamental objects. (*See* Turtle.)

THE TOUCAN AND HIS BILL



How can Mr. Toucan hold his head up with such an enormous bill to support? The answer is that the bill is extremely light, the outside being very thin and the interior filled with a network of bony fibers which gives strength without weight.

TOUCAN. The toucan is a bird freak, for it has an enormous bill larger than its head, shaped like a great lobster claw, and marked with bright colors. No satisfactory explanation has ever been given for this extraordinary feature. The tongue is also unusual, for it has side notches and is flat and feather-like; and the tail is joined to the body with a ball and socket joint, and can be raised above the back with a jerk. The black and green plumage is marked with white, orange red, or blue; and the eye, with a double iris of green and yellow, has a broad blue orbit and is surrounded by a patch of bare orange skin. There are 50 to 60 species, all natives of tropical America.

The common toucan, *Rhamphastos toco*, is about two feet long. It is most abundant in the Amazon valley; some species are found in Central America and Mexico. It feeds on insects and reptiles, and also eats bananas and oranges, often doing great damage to orange orchards. The nest of this curious bird is in a hollow tree; the eggs are white.

TOUCH. "How many senses have you?" The answer most people give to this question is "Five"; and they name touch as one of the five. But a little experience and thought show there are really four separate senses localized in our skin. Often the sensation we get from contact with objects is a combination of two or more senses.

First there is true touch or "tact." This is aroused by light contact of any object with the skin.

Second, there is the sense of cold aroused by objects of a lower temperature than the skin. This anybody recognizes as quite different from touch. Indeed it does not require contact of any solid object at all. If there is a cold object near by, we know it.

Third, there is the sense of warmth. This is quite distinct from both touch and cold and is felt when the temperature of the skin is raised.

Fourth is pain. This is caused by excessive stimulation or injury. Any sensation may become painful if its intensity becomes too great.

It can be shown by going carefully over a small area of skin with a light hair or wooden point that the touch sensation can only be aroused in certain small spots. This is because there are special nerve endings for touch and these are scattered closely throughout the skin. So too with the other senses; each has its own nerve fibers, its own pathways in the spinal cord, and its own center in the brain.

You can test the sensitiveness of touch in several ways. For example, take a pair of compasses and find out how far the points need to be spread apart in order to be recognized as two. This is a good game for two to play at. One should be blindfolded. The other should lightly apply the compass points, one or both at a given moment. The first person should say whether he feels one or two points. See how many mistakes you make playing this game.

On the lips and fingertips you will recognize the two points when quite close. On the back of the hand or of the neck they must be quite far apart.

If one takes a cold blunt point, he can localize "cold spots." These are sensitive to cold but not to touch or heat. Heat and pain spots can be found by similar experiments.

The Sense of Location on the Skin

We are so used to being stimulated by contact in various parts of the body that we can tell pretty accurately what spot is being touched. This is called the "local sign." Another good game is for a blindfolded person to put a finger as exactly as possible on some spot another person has just touched with a pencil or toothpick. You will find that there is a good deal of difference in the exactness of localization on various parts of the skin.

Touch is important in giving us information in regard to contact, shape, smoothness or roughness, etc. You can "fool" the sense of touch if you get the endings out of their usual relation. For example, cross your fingers and feel of a marble or the end of a pencil. It will feel like two objects.

In addition to the four senses already named there is a sense of pressure, connected with the muscles and joints and the skin. By this we judge weights. By the so-called "muscle sense" one can tell the position of any limb pretty accurately. If the arm of a blindfolded person be bent by another person, the first can tell at about what angle the arm is bent.

In the blind the sense of touch becomes very important and can be cultivated to a high degree. Helen Keller, who was blind and deaf from babyhood, became a very wise and cultivated woman by learning to read and converse by the sense of touch. (*See* Blind, Education of.)

TOWNSHIP. When the Puritan Fathers came to Massachusetts they settled in little compact communities called "towns" or "townships." In each of these a meeting-house was erected for church services, and there the voters of the town also met from time to time in town meeting to make their local laws, elect their local officials—especially their "selectmen" or executive committee—and transact other business. The other New England colonies, as they were established, adopted the same form of local government.

In colonial Pennsylvania most of the duties discharged by the New England town meeting were assigned to the county governments. But still there were a few functions which could best be performed by officers of a smaller community, and so Pennsylvania too adopted a "township" government. In this colony, however, no town meetings were held, for the township officials were elected at the general election and the administration of the township was left entirely in their hands. New York and New Jersey adopted a plan of township government midway between Pennsylvania and New England. In the colonies south of Pennsylvania, local government centered in the county and the parish.

In the new states north of the Ohio River and east of the Mississippi, and in the first tier of states north of Arkansas and west of the Mississippi, township government was adopted of the New York or Pennsylvania type. In the other states of the South and West there are no townships in the political sense.

In five other states that have township government —Ohio, Indiana, Missouri, Iowa, and Kansas—there are no town meetings, and the officials are elected by ballot at the time of the general election. In the other states which have townships, outside of New England, the officials are elected and the more important business transacted at a town meeting of the voters of the township, but these meetings are only faint shadows of their New England prototypes. The meetings are usually held in the spring of each year, but may be called at other times. The officers elected include supervisors or members of the executive committee by whatever name they are known, a town clerk, assessor, treasurer, constable, etc.

The functions of the township government include the building and upkeep of country roads, bridges, schools, etc., the administration of poor relief, and taxation for those purposes. Often the township officials will order you to cut the weeds along the road adjoining your property, muzzle your dog during the hot summer days, and keep your horses and cattle from running at large.

The people living in cities in most cases do not take part in the town meeting or in the township elections, for they are under municipal rather than township government.

The word "township" is also used in another sense, as a unit of the surveys of public lands made for the Federal government since 1785. Such land survey townships are six miles square. In many states the boundaries of the political and the land survey townships coincide, but this is not necessarily true.

TOYS. When your grandfather was a boy, his toys were a top made from an empty spool, a whistle cut from a willow tree, and a newspaper-covered kite with a long rag-tail—all of which he made himself. Yet if the top would spin, the kite fly, and the whistle send forth its shrill piping note, he was just as proud and happy as you are when you set up your toy wireless apparatus or run your toy trains on elaborate tracks. If your grandmother had a "store" doll besides her home-made rag-baby, it probably had a china head with shiny painted china hair that wouldn't comb. Dolly was served from a "pretend" cupboard, on bits of broken dishes, but her mud-pies and saw-dust

cakes were as good as any you can make in your doll kitchen, for all its model range and enameled baking dishes.

If toys make children happy, Uncle Sam's boys and girls are the luckiest in the whole world. He gathers their toys from every corner of toy-land. In one playroom may be found such a variety as a Swiss chalet with a music-box inside, curious kites and paper tricks from Japan, wooden-jointed jugglers from Germany, papier-mâché soldiers from Spain, games of endless variety, and dolls of every size and kind from every land.

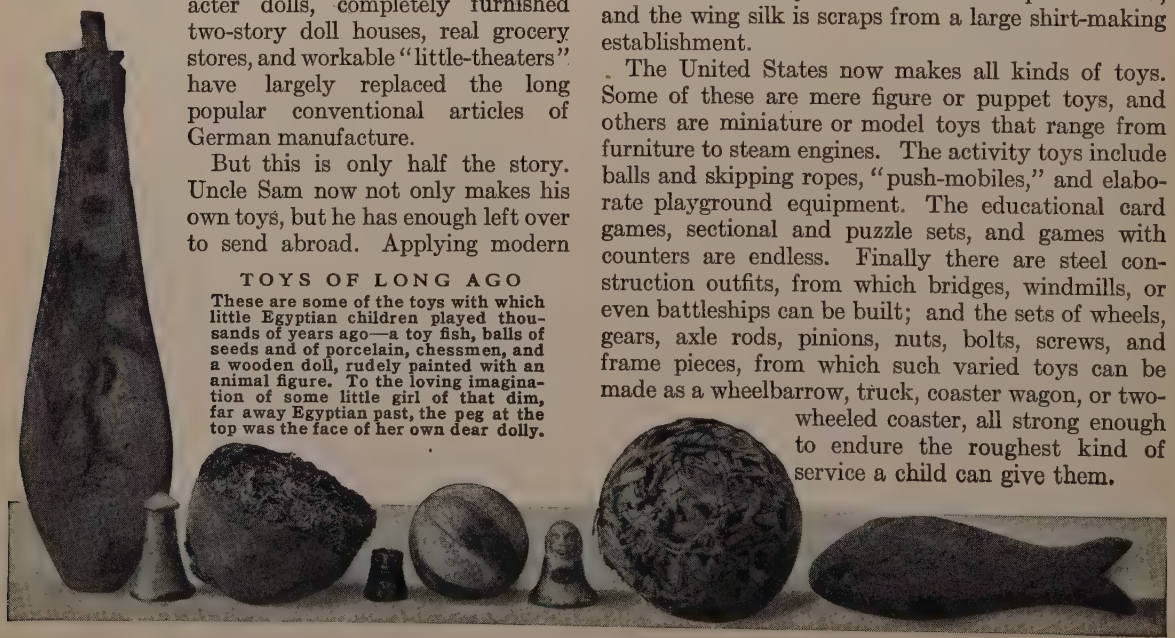
For many years Germany and Switzerland made most of the toys for the whole world, for in both these countries there are whole communities that are entirely given over to toy-making. Imagine a whole valley where one family for generations has made rocking horses, another dolls' heads, another dolls' arms or bodies! Season after season buyers of toys were satisfied with the cheap wooden animals, tin mechanical toys, and pretty dolls made by these Old World workers. Then toy-makers began to experiment with more elaborate toys and even educational toys. The result was novelties of which the older generations had never dreamed. What would those earlier children have thought of a three-foot electrically-propelled cruiser with complete wireless apparatus; a fire truck that comes right up to the doll house and hoists its own ladder; a knock-down and assemble outfit from which a boy can make his own truck, tractor or automobile that will run on its own power; or an airplane that will fly three or four hundred feet on a single winding? Such toys as these, expensive though they are, have lessened the demand for Noah's arks, woolly dogs, and toy drums and trumpets; while Uncle Sam's character dolls, completely furnished two-story doll houses, real grocery stores, and workable "little-theaters" have largely replaced the long popular conventional articles of German manufacture.

But this is only half the story. Uncle Sam now not only makes his own toys, but he has enough left over to send abroad. Applying modern factory methods to their making he is often able to sell his toys at prices which European hand workers cannot meet. The materials used are frequently scraps or by-products from other industries. Thus there is one toy factory that buys 60 different kinds of wood scraps and uses several car-loads a day; while in another which makes toy airplanes, the bamboo wing-ribs come from a factory that makes bamboo porch shades, and the wing silk is scraps from a large shirt-making establishment.

A YOUNG STRUCTURAL ENGINEER AT WORK

Having erected his own steel derrick this young structural and electrical engineer is now installing the hoisting machinery. The little electric motor is screwed on the right end of the plank to which the steel girders of the tower are secured. A belt carries the power to the wheel at the foot of the structure and operates the "walking beam" and the rest of the machinery.

The United States now makes all kinds of toys. Some of these are mere figure or puppet toys, and others are miniature or model toys that range from furniture to steam engines. The activity toys include balls and skipping ropes, "push-mobiles," and elaborate playground equipment. The educational card games, sectional and puzzle sets, and games with counters are endless. Finally there are steel construction outfits, from which bridges, windmills, or even battleships can be built; and the sets of wheels, gears, axle rods, pinions, nuts, bolts, screws, and frame pieces, from which such varied toys can be made as a wheelbarrow, truck, coaster wagon, or two-wheeled coaster, all strong enough to endure the roughest kind of service a child can give them.



TOYS OF LONG AGO

These are some of the toys with which little Egyptian children played thousands of years ago—a toy fish, balls of seeds and of porcelain, chessmen, and a wooden doll, rudely painted with an animal figure. To the loving imagination of some little girl of that dim, far away Egyptian past, the peg at the top was the face of her own dear dolly.

For any subject not found in its alphabetical place see informatio..

The history of toy-making goes back to the very beginning of the human family. Dolls, tops, balls, and rattles have been found in the most ancient tombs of Egypt. Jointed dolls moved by strings and small models of furniture painted with scenes of children's life have been found among ruins of ancient Greece and Rome, and every country and age has had its similar toys and games.

GROOMING THE HOBBY HORSE

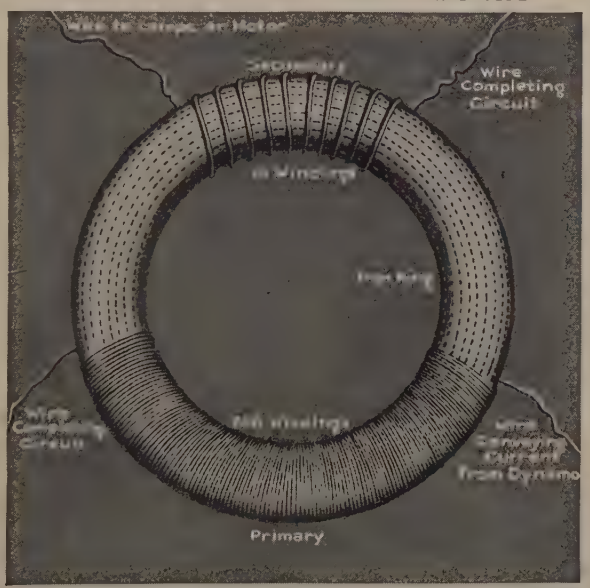
This rocking horse is being smoothed down on a sandcloth belt; later it will be painted and receive mane, tail, saddle, bridle, etc.

TRANSFORMER. You have often seen large iron cases attached to poles carrying electric wires, and perhaps in your rambles in outlying parts of your city you have run across huge boxlike affairs, twice as tall as a man, with wires running to and from them. These are electrical transformers. What are they for and how do they work? You can find out by a simple experiment.

Wind two coils of insulated wire around an iron core and send an electric current through one. A galvanometer will show that, at the instant the current starts through this first coil, a current in the opposite direction starts in the second, stopping instantly. This induced current in the secondary coil does not flow again until the current in the primary coil ceases to flow; then another momentary current is induced in the secondary coil, this time in the same direction as that in the primary coil. This is the principle of the *induction coil*, which is exceedingly important in the commercial utilization of electricity.

If, instead of a periodically interrupted direct current, an alternating current is passed through the primary coil, each change of current will induce a momentary opposing current in the secondary coil. When the number of turns in the windings of the two coils is the same, the currents are practically equal. Where there are ten windings in the primary coil to every one of the secondary, the voltage in the secondary coil will be one-tenth that of the primary; where there is one winding in the primary coil to every ten in the secondary, the voltage in the secondary coil will be ten times that of the primary.

HOW THE TRANSFORMER WORKS



The primary wire is bringing a current of 2,000 volts, let us say, from the power station. The number of turns in its windings around the core is 20 times that of the secondary wire. The latter, therefore, carries to the lamps or motor 20 times the volume of current (amperage) at 1/20th the pressure (voltage), in this case 100 volts. The rule of transformers is that the same amount of energy (amperage×voltage) goes out as comes in, minus the energy lost as heat.

The coil with the more numerous windings is the high-tension coil; the other is the low-tension coil. The transformer with a high-tension primary coil and a low-tension secondary, receiving current at high voltage and delivering it at low voltage, is known as a step-down transformer; the reverse is a step-up transformer.

Now electric current is usually distributed at much higher voltage than can safely be used, because it requires a much smaller wire to transmit a given amount of electrical energy economically at high voltage than at low. Step-down transformers are used to lower the voltage to a pressure suitable for use. Thus in power houses, the dynamos commonly generate the current with a voltage of 2,200 volts, and in the step-down transformer on the poles this higher voltage is reduced to 110 volts for use in the lamps and small motors of the house. One ampere at 2,200 volts should be transformed into 20 amperes at 110 volts in a perfect transformer; in good transformers, this ideal transformation is reached within a few per cent.

In long-distance electric power lines, the current is carried at much higher pressure. In some of the great hydroelectric systems, such as those on the Pacific coast and at Niagara Falls, power is transmitted hundreds of miles at voltages of 60,000 or 100,000. Even higher voltages, it is expected, will soon be in common use. Step-up transformers are used at the generating stations to raise the voltage, and in the neighborhood of the receiving cities enormous step-down transformers

contained in the Easy Reference Fact-Index at the end of this work

reduce the pressure to about 2,000 volts. Local transformers can then reduce the voltage to pressures suited to the needs of customers.

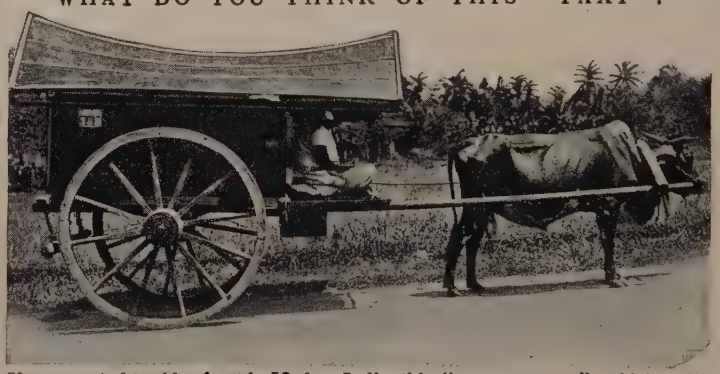
In addition to this commonest type of transformer, the stationary or alternating current transformer, there is another type called the *rotary* transformer used for changing an alternating current into a direct or vice versa. A rotary transformer is really an electric motor and a dynamo combined into one machine. (*See also* Electricity.)

TRAFFIC *and* TRAVEL *by* LAND, SEA, *and* AIR

How Ancient Men Had to Carry Their Own Loads—The Invention of the Wheel and the Training of Beasts of Burden—The Wonderful Influence of Ships—The Final Triumph of Self-Pushing Machines

TRANSPORTATION. Man, in the beginning, was his own beast of burden. To enable him to increase his load he invented various simple devices such as yokes to suspend weights from his shoulders and rude sledges for dragging loads along the ground. The invention of wheels—at first merely circular cuts from tree trunks—greatly increased the weight of the load that could be carried and the speed of travel. This invention must have been made 4,000 or 5,000 years ago by the primitive Indo-European peoples from whom most of the races of Europe have sprung. We know this because the same word, variously modified, means "wagon" in the various tongues which grew out of the Indo-European parent language (*see* Philology).

WHAT DO YOU THINK OF THIS "TAXI"?



If you wanted to ride about in Medan, India, this "one ox-power" vehicle, with its sway-backed roof, is what you would hire.

By the time of the invention of the wheeled vehicle, man had already tamed the ox and the ass and taught them to carry loads and to draw plows; we find records of their use in Egypt as far back as 2,700 years before Christ. The horse did not appear until much later, and then it was used chiefly in war. It was first introduced among the Babylonians about 2100 B.C., coming from the Indo-European nomads of the northern grasslands. From Asia the horse was brought to Egypt about four centuries later, and used to draw the war chariots of the pharaohs.

In other climates and conditions, other animals were domesticated as beasts of burden. The camel became the "ship of the desert" in very ancient times. The elephant was trained for riding and to carry heavy loads in the Far East. The llama became the pack animal of South America, the yak of Tibet, and the water buffalo or carabao of the Philippine Islands. Dogs are used on small carts of European countries, and Eskimo dog trains and reindeer do much of the carrying in the arctic regions. The ox cart and the prairie schooner drawn by horses, oxen, or mules served faithfully in the early days of America.

But long before men had invented the wheel or tamed the ass, they had learned that a hollowed tree trunk or the inflated skin of an animal could be easily propelled through the water with a flat piece of wood, and ancient civilizations sprang up along rivers and on seacoasts where this cheap and easy mode of transportation was available. It did not take men long to improve on the hollow log and to build boats and ships of considerable size, and to fit them with sails. Early in the dawn of Egyptian civilization, ships came into use on the Nile, and the pharaoh's subjects even ventured out into the open Mediterranean, to trade or make war.

By 1000 B.C. the Phoenicians had succeeded the Egyptians as a seafaring power, and the Mediterranean was alive with their swift galleys, carrying purple garments and ivory combs and jewelry among the new Greek settlements. The Greeks too took to a seafaring life, and within a few centuries their trading vessels were known in every inhabited nook and inlet of the Mediterranean world. Then the Roman galleys in their turn swarmed over the inland seas and along the Atlantic coasts of Africa and Europe, followed still later by the ships of Venice, Genoa, Florence, and the other wealthy city-states of Italy which arose on the ruins of the Roman Empire.

By Landmarks and the Light of Stars

These early mariners sailed by landmarks and the light of the stars, and so they did not venture far from land. Not until the invention of the compass, which came into use about 1300 A.D., was it possible to steer boldly out into the open sea. Finally in 1492 Columbus crossed the Atlantic, and 30 years later Magellan sailed around the world.

On the right are shown, from bottom to top, some of the steps in shipbuilding from remote to recent times: first, an Egyptian craft of the fourth dynasty with A-shaped double mast and paddlers facing forward; then a Mediterranean galley of the 16th century; an Oriental junk; an East India merchantman of the 19th century; an early side-wheel transatlantic steamship still carrying sails; a modern transatlantic liner; and a cargo vessel equipped with an oil burning (Diesel) gas engine. On the left is progress in land transportation from the solid-wheeled oxcart, the reindeer, the yak, and the "prairie schooner," to "Puffing Billy," pioneer locomotive, with a modern motor transport to the right, and a modern steam locomotive and an electric locomotive above. Across the top of the page are, on the left, early types of the biplane and monoplane; in the middle, a modern dirigible balloon; on the right, a modern type of passenger-carrying biplane.

contained in the Easy Reference Fact-Index at the end of this work

Thus we get a glimpse of the great part which transportation by land and water has played in history. Civilization means transportation. The backward peoples are the isolated peoples, who have not the means for coming into contact with others. Without the magnificent roads which the Romans built in a network all over their conquered territories, there could have been no Roman Empire. The story of America is linked with its waterways. Colonists settled on the coast in the vicinity of good harbors, and the lines of exploration and settlement inland were the lines of the navigable rivers. Most of the great cities of the world—London, New York, Paris, Chicago, Constantinople, Rome—owe their being mainly to their advantageous position on waterways, which still remain the cheapest means of transportation. The greatest handicap which today retards the development of some South and Central American states is the lack of railroads and steamships. The railroad mileage of a nation may be taken as an indication of the stage of civilization it has attained.

When Travel was a Perilous Adventure

To the development of transportation is largely due the enormous economic revolution that has taken place in Europe and America since the 18th century. Up to that time travel remained a difficult and daring enterprise, more so than it had been in the days of the Roman Empire. Most roads were mere cart-tracks, worn into deep ruts and so deep with mud in bad weather that for half the year wheeled vehicles could hardly be dragged through them. In France, when the famous Madame de Sévigné set out by carriage to visit her daughter, 200 miles away, she made her will and regarded the undertaking as more hazardous than we today would regard a journey into the heart of India or around the world. And in England there was so little travel that a writer 50 years later said: "It is scarcely half a century since the inhabitants of the distant counties were regarded as almost as different from those of the capital as the natives of the Cape of Good Hope. Their manners, as well as their speech, were entirely provincial." (*See* Roads and Streets.)

The revolution, in England, came in the middle of the 18th century, with the construction of great numbers of good hard roads radiating from London in all directions. Canals too were made for the transportation of bulky goods like coal and iron to supply the great new manufactures which were springing up with the development of factories and the steam-engine (*see* Canals). Similar changes took place on the Continent and in the United States. In the United States the first stagecoach line was established between New York and Philadelphia in 1756.

When Steam was Put in Harness

The modern industrial era received a second great impetus with the introduction of the steam railroad and the steamboat in the early years of the 19th century. Then for the first time in history transportation became cheap and speedy enough to make it possible to draw on all parts of the world for raw materials and to bring them together at convenient centers for manufacture, and to ship the manufactured articles wherever there was a demand for them. Today the world is girdled with a vast network of railroads, which, together with the steamships, make the products of the remotest nations almost as accessible to the great industrial nations as if they were next door. (*See* Railroads; Ships.)

Steam and electricity have annihilated space. No longer is it pardonable for one nation or one part of a country to have abundance while neighboring districts or states are famine-stricken. Each nation can produce and manufacture the articles for which it is best adapted and exchange these with other states for other products. Few European nations produce sufficient foodstuffs to feed themselves; they rely on the great agricultural nations to feed them, in exchange for manufactured goods.

Transportation is the fundamental factor in modern society. Without cheap and speedy communication there could be no such great nations as we have today. It was the rocky barriers which shut off each Greek tribe from its neighbors that made the Greeks a group of small and weak city-states, instead of a great empire such as Rome became. The Philippine Islands, lying on the other side of the globe, are in closer touch with the United States today than were the Atlantic and Pacific states before the days of the transcontinental railway. (*See* Commerce.)

Stop and think what would happen if the railroads should stop running for six months. Not only would every branch of industry be paralyzed, but our great cities would be famine-stricken. Hence railroads, steamships, trolley lines, and other means of transportation are called "common carriers" and are put in a class apart from other businesses. They could do such infinite damage to individual firms or whole sections of the country by discrimination in rates and service that every country exercises supervision over their operations, and in some countries the government owns and operates nearly all the transportation facilities. (*See* Public Utilities.)

TRANSVAAL (*trăns-väl'*). A province of the Union of South Africa between the Vaal River on the south and the Limpopo on the north, separated from the coast by Portuguese East Africa. This region was settled by the Boers who trekked northward from Cape Colony after the British had issued their edict emancipating the slaves in 1834. There were various conflicts with the natives, especially the formidable Zulus, and with the British. These latter led to a temporary annexation of the Transvaal by the British in 1877. A British-Boer war which followed in 1880 saw the defeat of the British at Majuba Hill in 1881; following which the independence of the Transvaal was restored, except for British suzerainty over its foreign relations. More formidable difficulties resulted when gold was discovered in the famous Witwatersrand, in 1884, and foreigners (Uitlanders)

flocked in by thousands. Oppression or denial of political rights to these immigrants, under the administration of President Paul Kruger, led to an unsuccessful raid from the British South African territories, headed by Dr. Leander Jameson in 1895. After prolonged negotiations, the three-years' Boer War (1899–1901) followed (*see* Boer War). By the peace of Vereeniging the Transvaal became a British colony. Self-government was granted in 1906, and in 1910 it became a part of the newly formed Union of South Africa (*see* South Africa). The government is carried on by an Administrator and a Provincial Council.

The Transvaal is exceptionally rich in minerals. Besides gold, the chief source of wealth, there are diamond, coal, copper, iron, lead, and silver mines. The country is well adapted to agriculture, and stock-raising is still carried on extensively by the Boers, who comprise about half of the white population. Corn and tobacco are the chief crops. The largest city is Johannesburg (population, about 240,000), the center of the great Witwatersrand gold fields. Pretoria (60,000) is the capital of the province. The area of the Transvaal is 110,426 square miles; population, about 1,700,000, of whom 500,000 are whites.

OVER WILD TRAILS *with the* TRAPPER

Adventurous Life in the Far-Away North when the Bitter Winds Howl and Snow Covers the Ground—Making the Lonely Rounds of the Traps—Prices Paid for Pelts—Amateur Trappers on the Farms

TRAPS AND TRAPPING. Soon after the leaves begin to turn in the fall, thousands of sturdy woodsmen take the trail into the remote valleys of the Rockies or the Coast Range, into the woods of the northern states, or into the great lonely places of the Far North. Even before that, the Indians and halfbreeds of Canada have packed their worldly belongings into canoes, visited the trading-post of the Hudson's Bay Company, got an advance of money and goods to carry them through the winter, and paddled off toward the arctic cold. These are the soldiers of fortune who supply a large part of the furs that adorn our garments and keep us warm in winter.

When they get to their wonted trapping grounds—the white men one by one, the Indians usually in family groups—the trappers build a permanent camp and make things as comfortable as possible against the days when blizzards rage and the thermometer sinks to 50 or 75 degrees below zero. The animals are now beginning to grow their thick winter coats. Up to this time their fur is thin and almost worthless. When the first heavy snow falls, the trapper starts out, loaded with steel traps—as many as he can carry. Scanning the tell-tale foot-prints in the snow, he sees that here a fox has passed, there a mink, in another place a marten. At likely places he baits and leaves his traps—light ones for the smaller animals, heavy ones for the larger animals. So he swings around in a wide circle until all his traps have been set, sometimes a hundred or more. Then comes the daily work of making the rounds of as many traps as possible, to remove the animals that have been caught, to rebait those that have been robbed by animals too crafty to be taken, and to shift those untouched to likelier places. And when the rounds have been made, there still remains the work of removing and drying the skins. (Turn to page 1389 for a picture of a typical trapper's camp.)

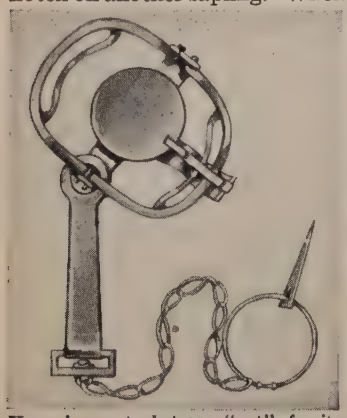
Thus the trapper spends his lonely days during the winter months, pitting his skill and endurance against the forces of nature and the cunning of the animals. Some years he is lucky; other years he may find that a great plague has swept his territory almost bare of fur animals, or that they have migrated to other grounds. Sometimes terrible storms rage, completely burying his traps. Then he must remember from landmarks where each one is, dig it out, and reset it. A hard life, and not a highly profitable one, for the trapper gets only a small fraction of the price you pay for a finished skin or fur garment; but it appeals to the red-blooded and adventurous, and so long as there are fur-bearing animals there will always be men ready to risk their lives to take them.

Various Ways of Capturing the Game

There are many ways of trapping or killing animals, but most of our furs come from animals taken in steel spring traps. In Russia shooting is still the common practice, but this is a wasteful method, since the shot or bullets always damage the skin more or less. For taking great animals alive—especially tropical animals such as lions and tigers—pitfalls are used, or trap-doors in which the animal as he crosses the threshold or touches the bait releases a trigger that drops a gate in place. Birds and sometimes other animals are snared with slip-knots. Deadfalls are traps in which a heavy log or other weight drops and crushes the animal when he touches the bait. Sometimes guns are set to be discharged by a line attached to the trigger. The Alaskan Indians have a knife-trap, in which a heavy blade attached to a lever pierces the victim when he touches the bait. Poison is also used at times.

All these methods are today considered inferior to the steel spring trap, which was perfected about the middle of the last century by an American inventor. This consists of two jaws, with or without teeth; it is closed by powerful springs when the animal steps upon a small "pan" between them. To prevent trapped animals from carrying the traps away, they are attached by a stout chain to a tree or stake. Traps

for smaller animals are often attached to the tip of a sapling which is bent down and held in place by a notch on another sapling. When the animal is trapped its struggles release the sapling, which flies up and carries trap and animal out of reach of other animals which might devour it. This also makes it harder for the animal to gnaw his own leg off, as he often does if the trap is left on the ground. Traps for powerful animals are usually attached to a pole, so that the victim can drag it about for a time. This makes it harder for the animal to break the trap by pulling, or to wrench itself free.



Here is a steel trap, "set" for its victim. A light tread on the central "pan" releases the catch; the great spring to which the chain is attached flies up, forcing the jaws together.

So wary and cunning are many animals that great pains are taken to destroy all traces of human presence and to make everything look as natural as possible. Sometimes the traps are handled only with gloves, and scents are smeared over them and dragged over trails leading to the traps.

How the Skins are Removed

Skinning the animals is an important and difficult task. This must be carefully done, as the pelt is less valuable if it is damaged. Usually in cold countries the animals are frozen when they are taken from the traps and must be thawed out before they are skinned. The skins of small animals are usually removed "closed." In doing this the skin on the underside of the hind legs is split up the leg, across the body, and down the other leg. The skin of the tail is worked off the stump without cutting and the skin of the body is "peeled" much as a glove is taken off. The skins of the larger animals are cut from the throat the full length of the body. Then the pelt is scraped to remove flesh and fat, and stretched on a board to dry.

When the ice breaks up in the streams and they begin to run brown, and when the animals start to shed their warm winter coats, then the trapper knows that it is time to pack up his pelts and take them to market. If he is in the Far North, he makes for the nearest trading-post, where experienced dealers examine his stock and offer him what it is worth—from a few cents for the smaller and less valuable pelts to $200 or $300 for a fine silver fox. If there are no posts of the big fur companies near, he sends his season's catch to a dealer in St. Louis, where they are disposed of at great auctions held every summer. Muskrat skins make the biggest item in the average trapper's catch, for although they bring only about 50 cents apiece, these animals are plentiful in nearly all parts of North America. For a blue fox the trapper gets about $50, for a fisher $20, for a timber wolf $15, and so on down to the rabbit, which brings him only about 10 cents.

The professional trapper, however, has no monopoly on trapping. On countless farms all over the country boys and girls and even men find sport in trapping foxes, skunks, raccoons, weasels, and other animals. The pelts, properly dried, are traded in at the store for food or clothing. At the end of the season the country merchant sends the stock he has accumulated to a dealer at St. Louis or some other large city. (*See also* Furs; Hudson's Bay Company.)

How to Make a Simple Trap

A good trap for rabbits and other small animals can be made from a medium-sized dry-goods box. First dig a hole in the ground just large enough to admit the box, and deep enough so that only about 12 inches of the box appears above the surface. In each end of the box, level with the ground, cut a hole about 6 inches square.

Into each one of these holes you now fit loosely a narrow box about 18 inches long, in such a way that one-third of its length projects inside the big box. From the top of the big box, midway between the two entrances, you hang the bait so it is visible through the smaller boxes. Then you disguise the outside of your trap with branches, or leaves, or snow.

Along comes Mr. Rabbit.. He smells and sees the bait, and apparently all he has to do is walk into one end of the tunnel, eat his fill, and walk out the other end. But as soon as he puts his foot on the inner

"THAT'S SURE TO CATCH HIM"

Placing their trap in the mouth of the groundhog's burrow, these amateur trappers feel confident that the farm pest will not plague them much longer.

FINE FURS FROM THE FAR NORTH

Here is a trapper's winter catch, brought to one of the distant trading posts of the Hudson's Bay Company, the greatest fur-trading organization in North America. Here are magnificent silver fox skins (both of the men in the fore ground are holding silver foxes), white foxes, otter, ermine (the small skins with black-tipped tails, at the left, are ermine), and almost every kind of fur known to the north.

end of the entrance-box, it tips up and drops him inside. The entrance-box then tips back into place, and Mr. Rabbit can't find any way out. A door for taking out the captured animals should be cut in the top of the big box.

TREATIES. Treaties are compacts or agreements between two or more states, much like contracts between individuals. They can be made, however, only by sovereign states. Thus the states of the United States cannot make treaties with a foreign power, or with one another without the consent of Congress; and the colonies of Great Britain and other countries are likewise restricted in their treaty-making power. The constitution and laws of every government determine in whom the power of negotiating treaties resides. In most European countries it resides alone with the executive or king. The constitution of the United States, while leaving the negotiation exclusively in the hands of the executive, provides for ratification by the Senate, "two-thirds of the senators present" concurring.

The most important class of treaties is political. Nations are created or destroyed, or their boundaries changed, by the treaties of peace by which countries settle their differences at the end of wars, as in the case of the treaties of Versailles, St. Germain, and Sèvres which ended the World War of 1914–18. Another class of treaties which have been important in making history are those forming alliances or leagues, such as the alliance by which France agreed to aid the United States in its war for independence in 1778. Usually alliances are ostensibly defensive, the nations agreeing to aid one another only in case of attack, as in the famous Triple Alliance of Germany, Austria, and Italy; and the Triple Entente of France, Russia, and Great Britain on the other side. Treaties of arbitration have become increasingly important—some for the settlement of particular disputes, as in the famous *Alabama* Claims (*see* 'Alabama' Claims), and others which provide for the peaceful settlement of any "justiciable" dispute which may arise (*see* Arbitration). Other political treaties determine boundaries, cede territory, or guarantee the maintenance of certain conditions, as the neutrality of Belgium and Switzerland or of the Suez and Panama canals. Agreements to mitigate the horrors of war have been incorporated in various treaties.

The increasing interdependence of nations has resulted in the growth of an enormous body of treaties relating to many subjects which are not political—tariff duties, fisheries, the slave trade, the extradition of criminals, postal laws, telegraphs, submarine cables, weights and measures, monetary standards, etc. These agreements are often distinguished from the political treaties by the name "conventions," but this distinction is not always observed. Many of these conventions have resulted in permanently organized international bureaus, like the International Postal Union and the Union for the Protection of Industrial Property (patents, trade-marks, etc.). International conferences in connection with such subjects —of which as many as 100 have been held in a year—

have paved the way for the Covenant of the League of Nations, which, in addition to obtaining international coöperation for the prevention of war, is planned to take over the regulation of many of these world forces (*see* League of Nations). The league also provides for doing away with the evils of secret treaties by a provision requiring the registering with it of all treaties among its members.

On account of the magnitude and importance of the interests involved, treaties become valid only when they have been ratified, and states may refuse ratification if their agents exceed their authority. With few exceptions, the negotiation and the ratification of treaties in European states are in the same hands, and ratification follows as a matter of course. In the United States, in several cases treaties negotiated by the president and the state department have been rejected by the Senate.

Refusal to abide by a treaty is a cause of war, unless it has been abrogated by mutual consent or otherwise annulled. If either party refuses to perform a single stipulation of the treaty, the other party is released from his obligations and the entire agreement ceases to be binding; or the injured party may insist upon compliance and demand indemnities for damages caused by the breach. Occasionally (as often in the case of commercial treaties) the period of the treaty's duration is stated in the treaty.

Many important treaties and conventions are framed by international bodies known as "congresses" or "conferences," such as the Congress of Vienna (1815) and the Congress of Berlin (1878). The determinations of such bodies are usually embodied in treaties, but at times are expressed in statements known as "declarations," such as the Declaration of Paris (1856) abolishing privateering and regulating blockade. "Concordat" is the name applied to an agreement between the pope and a secular power for the regulation of ecclesiastical affairs. (For list of Historical Treaties, *see* Treaties in Fact-Index.)

The KINDLY OLD GIANTS *of the* PLANT WORLD

How Trees Build, Defend, and Enrich the Land, and Furnish Fuel, Shelter, Food, and Tools to Men—The Garment of Perpetual Youth which Keeps the Oldest Living Things Forever Young

TREES. Nothing in all the plant world is so rooted in the affection and the veneration of mankind as the tree. The friendly, fostering, kindly tree! Its beauty is a never-ending delight; its living branches afford shade and shelter; its fruit or its nuts furnish food; and its felled trunk gives us houses, furniture, tools, weapons, and fuel. A single species may supply nearly all the more important of the simple wants of primitive men. From one part or another of various trees civilized peoples obtain the most important of the fruits; nearly all nuts; coffee, chocolate, and cocoa; nutmeg, mace, cloves, allspice, and cinnamon; sago; maple sugar; olive oil, almond oil, and coconut oil; quinine; camphor; timber and timber products; cork, dyes, paper, and rubber, as well as turpentine and various gums, resins, balsams, and essences.

What is a tree? "A woody perennial plant," says the dictionary, "having a single main stem or trunk (as distinguished from a shrub, which may have many stems from a single main root), commonly exceeding ten feet in height, and usually bearing a head of branches and foliage or a crown of leaves at the summit." Although the dictionary admits "no exact line of demarcation" between shrubs and trees, we usually feel that "tree" is a rather precise and definite term.

The slender beech and the sapling oak
That grow by the shadowy rill,
You may cut down both at a single stroke;
You may cut down which you will.

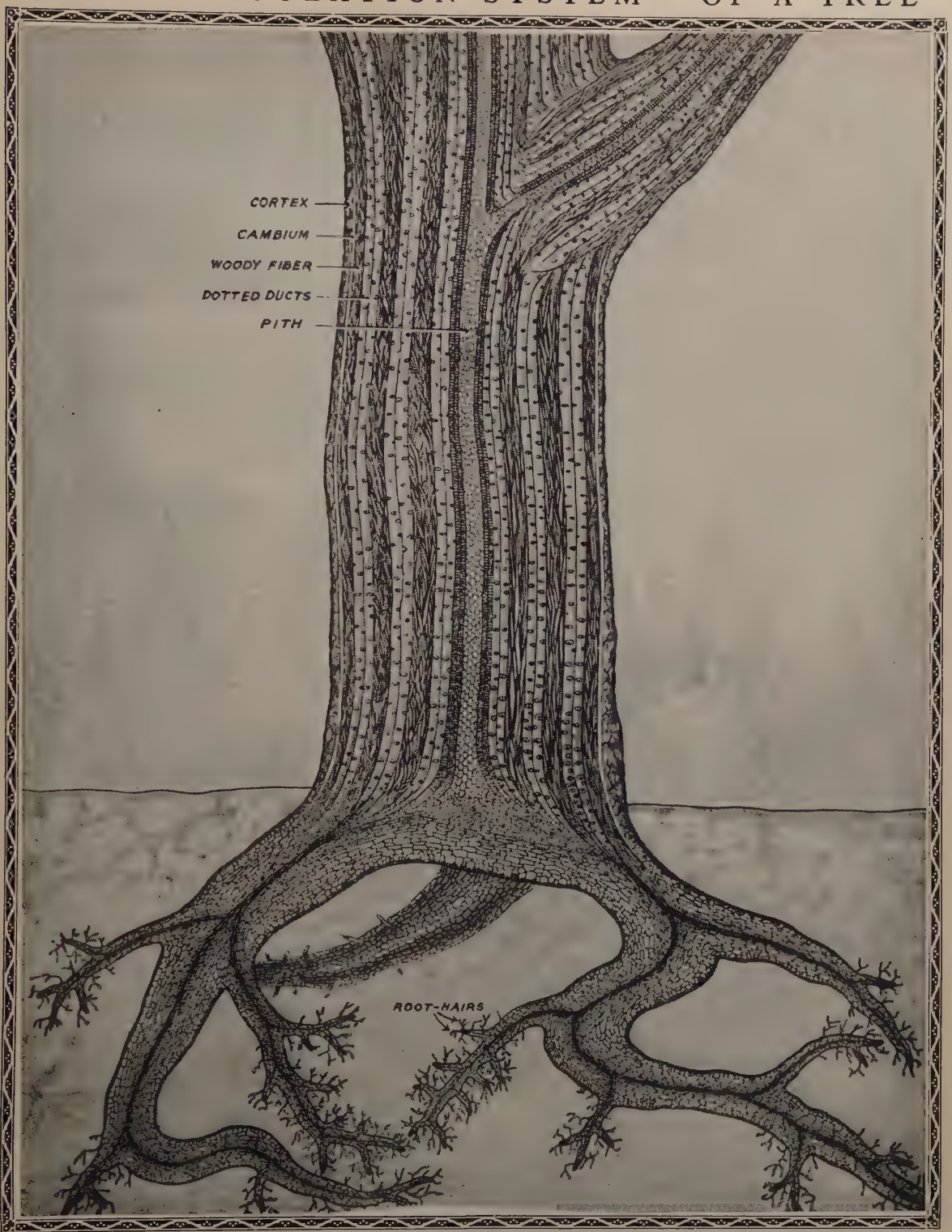
But this you must know: that as long as they grow,
Whatever change may be,
You never can teach either oak or beech
To be aught but a greenwood tree.

Yet a tree is merely a plant which has attained greatness in girth, height, and span of years; there is no botanical class of trees as such. The pea is the little cousin of the locust tree, for both are pod-bearers; the strawberry is kin to the pear tree, for both belong to the great rose clan (*see* Plant Life). As among human families, so among plants, some display a more decided tendency than others toward great size and longevity.

Roughly and broadly, the two main classes of our familiar trees may be described as: (1) conifers, naked-seeded plants, typically cone-bearing, needle-leaved or scale-leaved, usually of tall and slender habit and usually retaining their leaves throughout the year; and (2) broad-leaved trees with cased seeds, usually lower and more spreading in habit than the conifers, infinitely various in fruit and flower, and usually deciduous, that is, shedding their leaves at the approach of winter.

The oldest and hugest living things on the globe are to be found among the trees. Some of the giant sequoias of California reach a height of 300 feet. One of them was entering on its third millenium when Charlemagne was crowned at Rome; it was more than a thousand years old at the birth of Christ; it was centuries old when the ancient city on the Tiber, according to legend, was founded. Yet neither their size nor their age is so wonderful as their perennial youth. In sober fact, and no mere poetic phrase, every tree is clothed and garlanded with youth—even, some have thought, with a kind of potential immortality. The *cambium*, or cylinder of cells around the tree between the bark and the wood, is perpetually

THE "CIRCULATION SYSTEM" OF A TREE



The moisture from the soil, gathered up by the root hairs, passes upward through the dotted ducts of the woody fiber (xylem), and is distributed through the branches to the leaves. Here it helps to make the plant food, which descends through the sieve-vessels of the cortex. There the descending sap provides nourishment to the cambium, which is the growing portion of the tree, building upon one side the woody fiber and upon the other the corky fiber of the bark. The central part of the tree, including the pith, is dead, taking no part in the transfer of sap, but providing the strong support for the living outer tissue. As new layers of woody fiber are produced each year, the old ones die off, forming the annual rings by which a tree's age may be judged. All the parts are shown here much exaggerated for the sake of clearness.

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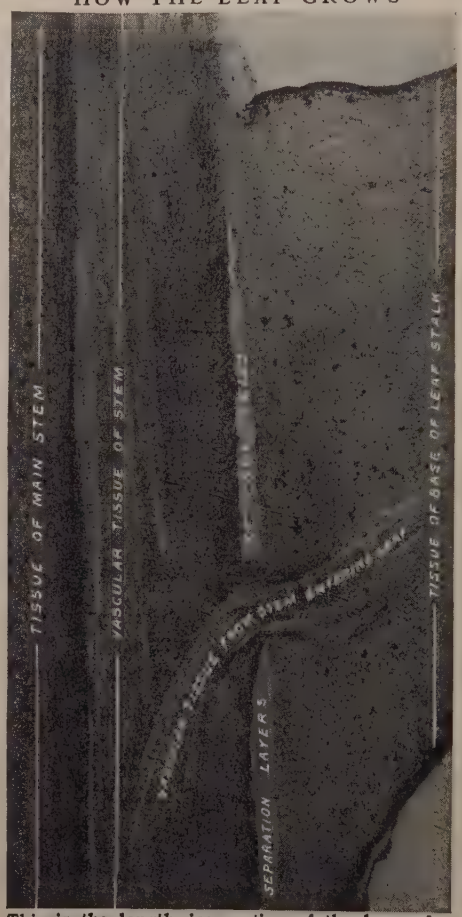
youthful tissue; the little cells at the tip of every twig have the same capacity of development as the cells in a just-sprouted seedling. The botanist De Candolle believed that trees do not die from old age, but only from injury or disease.

Each year the tree increases in girth by adding a cylinder of vascular tissue or sap-conveying wood, built up by the cambium, just outside last year's wood and just inside the bark (*see* Bark). In temperate climates each year's ring usually remains so distinct that the age of the tree may be estimated by counting the rings. Cellulose is the substance which stiffens the tree trunk as lime does the animal skeleton, and enables it to withstand enormous strain (*see* Cellulose). Gradually the sap ceases to run in the old wood; the life of the tree goes on between the bark and the heart, and at the tips of the branches. Hence the heart may decay while the tree continues to flourish with little depreciation of its chances for long life except through its slightly diminished mechanical resistance to the wind and increased lodgment to moisture. ("Tree surgery"—a new profession—repairs such damages by cleaning out the cavity and applying a waterproof filling much as a dentist cleans and fills a decayed tooth.) Yet, if the tree is cut down, it is the heart-wood that makes durable lumber; the sap-wood quickly decays.

HOW THE LEAF GROWS



This is the lengthwise section of the base of a horse-chestnut leaf-stalk, showing how the vascular tissue of the stem, carrying moisture and nutriment, branches off into the leaf-stalk, piercing the corky layer which wraps the stem.

This applies to the two great classes of our familiar trees, conifers and deciduous trees. Palms have no heart-wood, sap-wood, cambium, or true bark. Their vascular tissue runs in little stringy bundles scattered throughout the pithy trunk, as in a cornstalk. These trees, therefore, do not increase in girth annually, keep no record of their ages, and grow only at the top.

Even if we could dispense with lumber, firewood, paper, rubber, coffee, apples, peaches, dates, bananas, and all other tree products, our welfare would be seriously threatened by the destruction of the trees of the world. Trees perform indispensable services to the land itself.

They rank with grasses as defenders of the soil against waves and floods. Willows in cold and temperate regions and mangroves in the tropics are among the most efficient soil-makers and soil-binders. In wooded regions the temperature is more equable and the atmosphere moister than in treeless regions, other conditions being the same. The long roots of trees enable them to tap underground water sources inaccessible to shallow vegetation, and the wide spread of foliage of the large tree gives out an enormous amount of moisture (*see* Leaves). The moisture evaporated from an average white oak on a single summer day has been estimated to be 150 gallons of water.

Again trees have an immense influence on the fertility of the soil—not merely that underlying the forest itself, but that of the whole watershed which drains it. The leaf-mold of centuries produces one of the richest of soils, which is also spongier and more absorbent and retentive of moisture than naked clay or matted prairie, from which water drains as from shingles or felt. Thus the forests act as reservoirs of rain water, from which it drains slowly. Deforested regions, visited by infrequent torrential rains, are subject to destructive floods and drouth, and tend to become desert, as in famine-stricken China and to a slighter degree in deforested parts of the United States. The institution of forest reserves and of state and national forestry departments indicate an awakening appreciation of the invaluable service of trees (*see* Forests).

All trees are interesting; some are very strange. Among the strangest are the tropical mangrove and banyan, which send down from their extended branches roots that grow into supporting trunks, so that the tree in time becomes a grove (*see* Banyan). Then there is the baobab or "monkey-bread" tree, which grows immensely broad without growing proportionately tall, so that its trunk may measure 20 to 30 feet in diameter with a height of only 60 to 70 feet, while its branches, 50 to 60 feet long and each as thick as a good-sized tree, sweep the ground with their foliage. In South American forests are several different "cow-trees," which yield a creamy, pleasant-tasting juice, said to form an acceptable substitute for milk; these are generally related to the trees from which rubber is obtained. The "deadly upas-tree," whose

poisonous breath was once believed to be fatal to every living creature within ten miles, has been proved a traveler's fable; the real upas, however, has a poisonous juice.

There are on the solid portions of the earth three situations in which it is vain to look for trees: near the poles, on mountain tops above the timber line (which of course varies in height according to the latitude), and on the arid desert. Willow and birch, stunted to shrubs, grow farther north than any other woody plants. The north polar regions south from about latitude 70° are girdled with conifers, which usually form also the highest forest belt of mountains in all northern latitudes, and extend even into the temperate lowlands and beyond. The north temperate zone and southward is the kingdom of the broad-leaved trees, and breadth of leaf or density of finer leaf-growth becomes more and more a characteristic of tree foliage as we go from the latitudes of oak and ash, elm and willow, to those of palm, rubber tree, and banana. Certain families of the conifer tribe, in particular the curious Araucaria group, some members of which have comparatively broad leaves, occur in the tropics and are found here and there in the Southern Hemisphere, but they nowhere dominate as northern conifers do in the far north. The tough stunted Antarctic beech is the chief forest growth to defy gales that batter forever at the chill coasts of the extreme tip of South America.

The present distribution of trees, interpreted in the light of the geological record, forms the latest chapter in many a strange story. The North American tulip-tree and sassafras were believed to be the sole living representatives of their respective genera until the recent discovery of Chinese species of each genus. What means the occurrence of sister species isolated on opposite sides of the globe? Immense cosmic changes have swept the kinsfolk of our sassafras and tulip-tree out of existence, leaving only a single species of each at the eastern and western ends of the earth.

Tulip-tree, sassafras, and all their cousins in the vast connection of broad-leaved trees, however, are mere pushing upstarts compared with the real first families among trees, the conifers and the other naked-seeded groups. The giant sequoias and redwoods of the Pacific Coast are the sole survivors of one ancient and once widely distributed conifer group; the scattered Araucarias of the Southern Hemisphere are the feeble remnants of another formerly powerful clan. The cycads and that "living fossil," the ginkgo or maidenhair tree (*see* Ginkgo) have a lineage that goes back to the Coal Age—for, when we burn coal, we are burning wood and vegetable débris of a far distant past when the prevailing forest tree combined more or less many of the characteristics found in the modern fern, cycad, and conifer (*see* Coal).

Because trees live so much longer than human beings, many trees have become historic monuments. Such was the sacred bo-tree in India, under which, according to tradition, Buddha received enlightenment (the original tree has vanished, but a bo-tree in Ceylon, said to be over 2,000 years old, is venerated by Buddhists as sprung from a slip of the sacred tree); such were the King's Oak at Woodstock, England, the hunting lodge of Henry II; the Royal Oak which sheltered Charles II after his defeat at Worcester; the Charter Oak at Hartford, Conn. (blown down in 1856), which was said to have been the depository for the Connecticut charter demanded in surrender by Andros in 1687; and the Washington Elm at Cambridge, Mass., under which Washington in 1776 assumed command of the Continental Army. Besides sequoias, redwoods, and oaks, the trees which attain remarkably long life include banyans, cypresses, junipers, yews, olives, elms, and walnuts.

Among the lower or non-seed-bearing orders of plants, the tropical tree-fern is the only one to reach tree estate. Both of the two great divisions of seed-bearing plants, the gymnosperms or naked-seeded plants, and the angiosperms, or plants which hide their seeds in various fruits or seed-cases, include numerous kinds of trees.

The gymnosperms include the conifers; the small group of the tropical cycads, which most of us probably take for tree-ferns or palms when we see them in greenhouses; and the still smaller and stranger group of the ginkgoales, represented among living plants only by the Chinese ginkgo.

Of the two main divisions of the angiosperms, that in which the seed has a single lobe, as in corn and wheat (the monocotyledons), is represented among the trees only by the palms—unless we reckon that giant grass, bamboo, as a tree. The monocotyledonous lily tribe, too, has some treelike members—branched yuccas which grow 40 feet or so tall. All the other trees belong to the division with two-lobed seeds (dicotyledons). As bamboos, palms, giant yuccas, and tree-ferns are all tropical or subtropical denizens, it will be seen that all the trees of temperate and cold regions, as well as many tropical trees, are either naked-seeded plants (gymnosperms, of which practically all are conifers outside of the tropics), or plants with encased two-lobed seeds (dicotyledonous angiosperms).

Among the latter or "dicotyledon" class of plants, the most important tree group, including many of the best nut and timber trees, is found among apetalous plants, whose inconspicuous flowers lack the corolla and sometimes the calyx. They include walnuts, butternuts, and hickories, willows, poplars and cottonwoods, birches, alders, beeches, chestnuts, oaks, elms, mulberries, and the Osage orange. The polypetalous group of trees, having both calyx and a many-petaled corolla, is more conspicuous for beauty of flowers and for the number of fruit trees it contains than for its contribution to timber supplies, although several genera, particularly the maples and the lindens or basswoods, are valuable timber trees. It includes the great rose family in which are found the most valuable of our fruits—apples, pears, peaches, quinces, plums, and cherries, and also almonds, as well as such trees as mountain ashes and hawthorns. The polypetalous group also includes the magnificent magnolias, the tulip-tree, papaws, buckeyes, the horse-chestnut, dogwoods, the sassafras, bays, witch-hazels, sweet gums, plane-trees, hollies, tupelos, prickly ashes, and the pea family, in which the most important trees are the locusts. The highest group in the scale of development, that with flowers in which the petals are more or less fused into a tube (gamopetalous), contains comparatively few trees, particularly in temperate regions. Probably the most important of its groups economically is the olive family. Persimmons, catalpas, and sourwoods belong to other gamopetalous families.

The principal native trees of the United States include, among the conifers, something like 40 species of pines,

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larches or tamaracks, spruces, hemlocks, firs, arbor-vitaes, cedars, and junipers. Of monocotyledonous angiosperms the chief tree is the Florida palmetto; a few other palm species occur, mostly confined to the Florida keys. The branched yucca grows in the Southwest. The dicotyledons include the vast majority of American trees. Hickories are an exclusively North American genus, and 11 out of the 12 species, including the pecan, are found in the United States, the Mexican hickory being the exception. The sequoias, including the "big trees" and redwoods, now confined to the United States, were formerly widespread both in Europe and other parts of the world.

A Year in the Forest

THE splendid and wonderful tree! Years "sacred with many a mystery" bring to the ancient oak, not the feebleness of age, but increasing glory and majesty. Transitory generations of men succeed one another, and simple folk, to whose fathers' remotest fathers the giant tree has ever been immemorial, can only conjecture that it has stood "since the beginning of the world."

Is it so strange that mystic and fateful trees figure in the beliefs of primitive peoples? Rooted in earth and heaven, the mythical universe-tree Ygdrasil of the old Scandinavians bore life and death, good and evil, and all things else on its branches. Zeus declared his will to men through the oracular boughs of the oak at Dodona, and wise Athena could find no better gift for her chosen people than the olive tree. Gentle and lovely tree spirits haunted the fancies of other peoples besides the Greeks. Even down to our day, legend, poetic fancy, and homely old proverb cluster thicker than leaves about our familiar trees, all testifying to the importance of trees in human life.

How many of our common trees do you know? Perhaps you know several of them in the summer, when the leaves are on, but you ought to know them in every season of the year. You should know their height, their color, their spread of limb. You should know their bark, their leaves, their flowers, and fruits. You should know where each kind of tree likes best to grow, and what animals and birds and insects use it for a home. And you should know the forest as a whole, in all its seasonal changes.

After three hundred years of cutting down trees, the United States has begun to replant and protect them. Even the schools have a tree-planting day, Arbor Day, so little citizens can help in the work of winning back our lost trees. The more you know about trees, the more you can help in this work, and the more you will love them.

I. SPRING: "ROCKABY BABIES"

Where do you look for flowers in the spring, and when? On the ground, and in late April or early May? But why not look *up*, in March? The air is warmer than the ground in the early spring, and before the snow goes off the red maple lights the edges of the woods with its blood-red blossoms. The flowers are so small, and so bunched in little tufts on the sides of twigs, that you may think them only the first leaves, unless you know better and look close.

Look at them closely and you will find a number of tiny blossoms snuggled together, inside a raincoat of varnished brown scales lined with wool. The separate flowers are fairy cups, some with pollen pockets on little hairs, like clappers in bells, and others with eager arms or plumes stretched out asking for pollen. It takes both kinds of flowers to make the winged seed of the maple, and they both grow on the same tree.

A week or two later, look for the flowers of the rock or sugar maple. They are not so easy to see, for flowers and leaves come together, and both are a pale yellowish green. The whole tree has a feathery springlike look that tells everyone that the sweet sap is running up. The silver maple flowers early, too. Its blossoms are in thick short tufts of greenish white, much the color of the leaves. The flowers of all the maples grow on the sides of the twigs. The leaf-buds are at the ends.

The snow is still trickling away in little icy streams when the first pussy willows come out. You will not find them on the big willow trees, but on knobby willow shrubs that grow with their little webby root-feet in the water. The bark is a brownish-green satin, with gummy scale-covered buds along the slender leafless stems. These scales open, and furry gray noses poke out to take note of the weather. If the sun is shining, the pussies slip right out and sit, as if with toes and tails under them, like so many Maltese kittens. You like to rub the silken pussies on your cheek, and you almost expect to hear them purr.

When the April sun is quite warm, the black willow takes the brown water-proof caps from its flower buds, and pushes out some catkin tails as scaly as pine cones. Under the scales are seed bottles with eggs in them, but no yellow pollen. Somewhere near by there is sure to be another black willow tree with no eggs, but with pollen catkins as yellow as gold. The bees visit both trees for honey, and so carry pollen to the eggs.

All the catkin-bearing trees—the willows, alders, birches, and poplars—make feathered seeds. In April and May the woods are full of flying white flakes. One poplar is called the cottonwood because of the snow storm of downy seeds it sets loose. The birds use the cottonwood and willow seeds to line their nests with down.

The pollen-making blossoms of the elms are little chimes of bells, yellowish or reddish green and, in some kinds, greenish purple. They have so many sturdy little yellow-tipped clappers that you almost expect to hear them ring. Some of the blossoms have no clappers, but hairy arms that reach for pollen.

Oak trees also have two kinds of flowers. One kind is a dwarf catkin or cone, with several double pockets full of gold-dust. The egg flower is a tiny pink knob.

For any subject not found in its alphabetical place see information

THE GLORY OF THE ORCHARD IN SPRINGTIME

Spring is the season when the trees are born again, when the sap mounts in the winter-weary stems, and the buds burst out with their glorious new life. This apple tree with its clustered blossoms is rich with its Spring promise—each flower a token of the luscious fruit that is to come.

It sits away out on the end of the twig in a scaly cup, often snuggled up to a sister or two.

Do you notice that the grape has both of its flowers, the seed cup and the pollen threads, set in one blossom? This is the first one of the kind we have found. The same is true of the wild crab-apple, the hawthorn, the honey-locust, the horse-chestnut, and many other trees and shrubs. Plants with these united flowers are called the crown-bearers. They are of a higher order than those that have to make two kinds of blossoms to grow seed. The crown-bearers do not use their own pollen, but exchange it with flowers on other trees of the same kind. Such a flutter of silken scented petticoats; such a buzzing of bees and hovering of butterflies as goes on in those huge bouquets of pink and white!

This is the forest in flower. If you learn to know it and love it, it will call you out every day from March to June.

II. SUMMER: "IN THE TREE TOPS"

Summer is the leafy season. On nearly all trees the leaf comes as soon as the blossom falls. The first leaves are very small, and they are not green, but pink, red, yellow, gray, or white. They have been wrapped up in bed-clothes all winter. It takes several days of warm sunshine for them to turn green.

The leaf of the red maple tree, true to its name, is red. On the sugar maple it is a yellow-green, on the silver maple a shining green-white. When they grow to full size these maple leaves all have much the same form. In different members of a plant family there is a resemblance, as in a human family. You can learn to call each one by its "given," as well as by its "family," name by looking out for the differences.

When you see a tree with a leaf that would lie in a three- to five-inch circle, but that is cut down part way into five lobes, you would be safe in thinking that tree a maple. The lobes of the red maple are sharply notched and parted. In the sugar or rock maple, the leaf lobes and partings are more rounded. It is a darker, smoother leaf, too, and grows more thickly on an evenly balanced round-headed tree. The leaf of the silver maple is smaller, a sage green above, a cottony white below.

All the willows have long slender leaves. Each leaf is a narrow thin delicately-veined blade that grows by itself and alternately along a slender stem, making a sort of feathered branch. The pussy willow leaves are a bright green. The black willow leaf is broader and saw-notched, and it tapers toward both stem and tip like a canoe. It is bright green above and silvery underneath. The leaf of the white willow

THE GREENWOOD IN THE LEAFY PRIME OF SUMMER

From the month of June onward is the time to study foliage. Then the trees are spreading out their full-grown leaves with their many delicate shades of green and their varied and fascinating shapes. As the sun grows warmer, the growing thatch that roofs the forest grows thicker, spreading its grateful shade over stream and glade.

is a gray-green lined with silver, and it droops from yellow stems. The crack willow, whose twigs snap so easily, has a green leaf lined with a waxy coating. The weeping willow has long gray "weeping" leaves.

The oak leaf is irregularly shaped, like the oak tree. It is a long oval or pear-shaped leaf, usually narrowest at the stem end, and is deeply notched and lobed. It is strong and tough, as glossy above as if varnished, and rough underneath, with woody veins standing out like a network of cords. The scarlet, the red, and the black oaks have four or five sharp-notched lobes with broad partings, and each lobe is often notched again. The white oak has seven or nine narrow rounded lobes, with very deep rounded partings cut down almost to the midrib. The bur oak has five or seven broad round lobes and narrow partings. In the swamp oak the leaf is oval with shallow scallops, and the smaller live oak leaf has wavy edges.

The elm has an oval or egg-shaped leaf about three inches long, narrowest at the tip and just a little pointed. The elm leaf grows singly, on opposite sides of twigs, each a little advanced beyond the last, and making a neat, feathered spray. It is strong, saw-notched, short-stemmed, and firmly set, smooth above, rough underneath. From the midrib the veins slant upward, making evenly spaced broad V's, about a quarter of an inch apart from stem to tip. You might think these veins were laid off with a ruler. Isn't that a satisfactory kind of leaf? You could almost draw it without seeing it, couldn't you? The leaf of the beech tree is something like that of the elm, but thinner, softer, often fringed as well as saw-notched along the edges, and it is irregularly net-veined, not strongly feather-veined like the elm.

The paper or canoe birches have the prettiest fairy-like leaf in the world! It is a broad oval, three or four inches long, with finely toothed edges. The pointed tip is often curved over a little, in a graceful way. This is a way many leaves have of being a little out of balance. If you fold any leaf along the midrib you will find the two sides are never exactly alike. This is just as it is in faces. One cheek has a dimple, one eyebrow is lifted, or one eyelid drooped more than the other. It is these little things that keep any two faces, even of twins, from being exactly like any other, and gives every face what we call character, "personality," or individuality.

The birch leaf has this little tilt at the tip, now on one side, now on the other, with a little hollow cut-out below it. A thin fluttery transparent leaf, scantily scattered over the lacelike twigs of the slender white-barked trees, it glances like a butterfly and sifts

sunlight. A group of birches always have a dryad, wood-fairy look. You feel like stepping softly when you come upon them in some shy retreat in a forest. They look as if a snapping twig might startle them into taking flight.

III. AUTUMN: "WHEN THE WIND BLOWS"

What is it the magician says in fairy stories, when he makes the most surprising things happen?

"Presto, change!" and he claps his hands.

Jack Frost is this wonder worker of the forest. After a still, sharp night in October, the trees are great torches of gold and red.

It is the maples that first light up our woods with these flickering fires. Their leaves are never of one tint, but are mottled and shaded from lemon yellow to orange, flame-red, and crimson. To look up through the thin-leafed red maple in the fall is like looking through a splendid stained-glass window.

The oaks show no yellow, and the leaves are of a strong solid color. They range through all the reds from scarlet to wine, and then add warm browns and bronze greens. The elms and beeches are in russet yellows, the birches and poplars pure gold, the nut trees yellow. On every brook the willow leaves float like little fleets of sunny canoes.

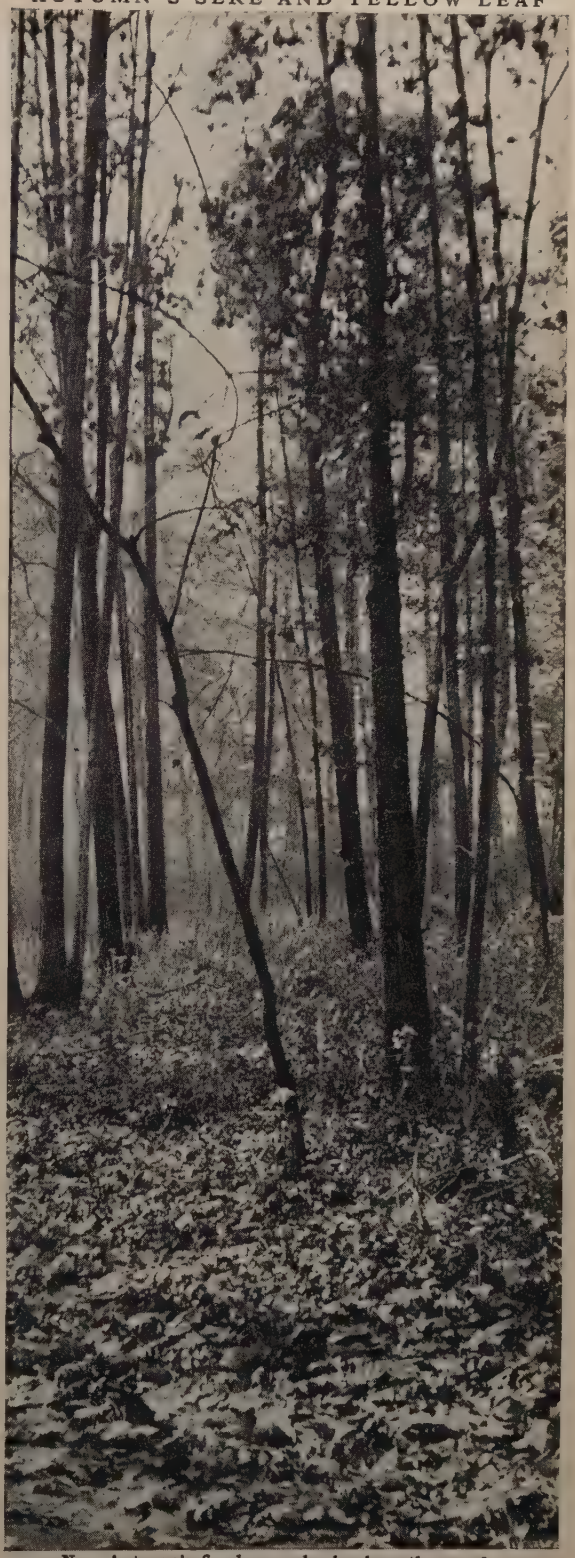
Below the boughs of the tall trees all these colors are repeated in the shrubs and vines. The sumac is a burning bush with torchcones of seeds. The broad leaves of the grapevine turn to bronze. The berry briars are dark as the wine oaks. The big smooth sassafras leaves are mottled in orange and flame, like the maples. There are notes of purple in the clusters of wild grapes, in the leaves of the alders and some of the ashes; and of scarlet in the seed hips of roses, the clustered berries of the mountain ash and of the bittersweet vine.

There is no hurry about anything. The autumn trees often take three or four weeks of Indian summer to strip their boughs for winter. The leaves drift down silently, like great colored butterflies. Whole troupes of them dance in little gusts of wind. On frosty nights the nuts drop with soft patterings. Squirrels slip, brown and gray shadows, over the bright carpets, laying in their winter stores. The song birds take their last meals of seeds and cocoon babies and fly southward.

October is the time to study the fruits of forest trees. Many of the trees—the willows, poplars, elms, and red maples drop their seeds in the spring. The rock maple keeps its seed until frost, and so do all the nut trees and the wild orchard fruits. All the maple seeds have two thin flat green wings, like a thumbscrew, an inch or more across. In the thickened bases of the two wings, two seeds lie coiled. You can peel away the thin paperlike covering and find them.

Acorns lie thick under the oak trees. They will tell you the names of the parent trees. Very likely all acorns look alike to you. They all have a shiny brown shell with a white "eye" where they grew

AUTUMN'S SERE AND YELLOW LEAF



Now Autumn's fire burns slowly along the woods,
And day by day the dead leaves fall and melt.

IN ERMINE AND DIAMONDS

At no time of the year are the trees more beautiful than in winter, when the black boughs and dark twigs are outlined against the gray sky with a delicate tracery of sparkling snow and the ground is thickly carpeted with white.

fast to the cups. The acorn of the white oak has a very rough, mossy cup much shorter than the pointed nut. The bur oak is often called the "over-cup" oak because its mossy fringed cup covers quite two-thirds of the round acorn. In the live oak of the southern states, the cup tapers back to the twig, broadens at the top, and almost encloses the acorn. The red oak has a shallow cup, more like a saucer, the scaly ring just clasping the long oval acorn. The scarlet oak acorn is top-shaped and is half covered with a shaggy cap of a cup, like a tam-o'-shanter.

Chestnuts are very near relatives of the oaks. The cups are closed burrs, very stiff and woody, with prickly thorns. You have to let Jack Frost open them for you. He can split them into four leaves lined with brown velvet, and make you a present of three dark brown flattened nuts with silky tails. They are very sweet when roasted by a winter fire. The squirrel is out after chestnuts before you are. Did you know he often peels his nuts, stripping the horny shell away, before storing them in his high pantry?

For two or three weeks our autumn woods are draped in splendor, and dropping their ripened fruits for squirrels and birds and little boys and girls to find. Then comes a gale of wind and cold rains. Suddenly the trees are bare, the birds are gone, the squirrels asleep in their cosy storerooms. The baby leaves and branches and blossoms for next year are tucked up snugly in tiny brown buds, all over the trees. You can find them in early winter, just above the scaly marks left by the leaves that have fallen. Every one of them is rain-and-frost-proofed in spicy gums and fleecy blankets.

Isn't it wonderful that these tender babies, some no bigger than grains of wheat, will be safe even when the ice is thick on the rivers and ponds? Winds that break off great limbs of trees and almost blow you off your feet will merely rock these babies in their cradles. And under the blankets of leaves and snow the fallen seeds will lie asleep, as snugly as Johnny Bear in his cave.

IV. WINTER: "THE CRADLES WILL ROCK"

Who says there is no use in going to the forests again until spring? What a mistake! It's worth while going if only for the pictures in black and white. The woods in winter, against gray skies and snowy earth, are delicate etchings. Then the boy with a kodak is lucky. He can make a whole album of pictures.

Every tree has a character of its own, just as every person has. Don't you know the members of your family and many friends by the way they stand and sit and carry their heads and swing their arms when walking? You don't always need to see their faces. You can learn to know trees in that way, too. Their characters seem to come out more sharply when they have no soft drapery of leaves to hide them.

The oak tree looks as if its shape were wrought of iron. No two oaks are alike, but all look as if hammered out on some giant forge. Its stout trunk,

covered with deeply furrowed black bark, is rooted like a rock. Often it is buttressed, or braced, by great ridges that slope away to outstanding roots. It supports a great weight of thick limbs, irregular and crooked. Clear up to the knotted twigs and tough brown leaves that often hang on all winter, the oak has a stubborn look. It dares the winter winds to do their worst.

The elm tree's black trunk, with the bark in deep vertical ridges, often springs 40 feet in the air, straight as a pine, before it branches. Then the long limbs sweep from the top like plumes from a vase. The elm was often planted for a lucky birth tree when a baby was born. The baby grew up before the elm did, but the tree lived long after he was gone. His children and grandchildren played under it while it was still a young tree.

Winter is the best time for studying the conifers, or cone-bearing trees. Perhaps you call all of them pines. Many people do, but only one of them is a pine, and you would never pick that one out for a Christmas tree. It has long stiff needle-like leaves that grow in clusters of from two to five. The clusters grow so close together that they spread in fanlike sprays.

The Trees that Grow for Christmas

Pines, spruces, firs, and hemlocks are alike in having cones and needle-like leaves. Most of them have tall tapering stems, like ships' masts and telegraph poles. The spruces and firs make the prettiest Christmas trees. The spruce has inch-long needles that bristle all around the stem. In the fir the needles are flat. They grow on only two sides of the stem and they slant upward. Sometimes the under sides of the leaves are pale and shining. Then it is called the silver fir. The cones of the two trees are much alike, long, slender, with thin close-set scales. But the spruce cone droops, while the fir cone stands erect. Hemlock needles are short and flat, too, but they lie straight out like the fronds of a feather. The hemlock cones are shorter, with bristling parted scales. All of these trees have a spicy balsam-like smell that is very pleasant.

The cedars are very different from the needle-leafed trees. The tiny flattened or spiny leaves overlap one another, making scaly or mossy stems. The flat-leafed arbor-vitae trees and shrubs resemble cedars. So do the round-stemmed cypresses, the junipers with purple berries instead of cones, the gnarly yew trees with their red or violet seed-berries, and the giant redwoods of California. Much like the cedars are the tamaracks, that grow in swampy places.

The cone-bearers put out new leaves in the spring after their blossoms, dropping the leaves from the older inner parts of the tree, leaving them quite bare, and strewing the ground with brown needles. All the branches and twigs are tipped with tender green tassels of new leaves.

Away up on the tip of the tallest pine is a long green feather. The Indians have a wonder story about that. When a young chief was turned to a pine tree by some bit of magic, he was allowed to keep his eagle feather. There the feathered tip of the pine waves proudly today, above all the trees of the forest.

TRENT AFFAIR. During the Civil War relations between England and the United States frequently became so strained that war actually threatened. The slackness of the British authorities in permitting the *Alabama* cruiser to be built in Great Britain and escape to prey on Northern commerce was felt by the Federal government to be a very serious offense (*see* 'Alabama' Claims). Almost equally offensive to Great Britain was the conduct of the United States in what is called the *Trent* affair.

In 1861 the Confederacy appointed James M. Mason and John Slidell as commissioners to England and France, to secure from those countries recognition and aid for the new government they were trying to establish. They left the South on a swift sailing blockade-runner, landed at Havana (Cuba), and there took passage on the English steamer *Trent*, bound for Europe. While in mid-ocean the *Trent* was overtaken by the United States steamer *San Jacinto*, and the two commissioners were taken from her decks by Captain Charles Wilkes.

Great Britain was intensely aroused by this invasion of its sovereignty, and it was only the wise counsel of Prince Albert, husband of Queen Victoria, that prevented the sending of a dispatch so peremptory that war must have followed. Cool-headed Americans like President Lincoln and Secretary of State Seward also condemned the action as contrary to international law. Lincoln declared: "We fought Great Britain in 1812 for insisting on the right to do precisely what Captain Wilkes has done." Mason and Slidell were held prisoners in Fort Warren, Boston Harbor, for nearly three months, but were then released in response to repeated British requests.

TRENT, ITALY. Trent lies in the center of the territory which the Italians before the World War called *Italia Irredenta* ("unredeemed Italy"). For more than a century the inhabitants of this mountain region had prayed for deliverance from the Austrian yoke. Their hopes were realized on Nov. 4, 1918, when the armistice terms signed by Austria provided for the surrender of this territory. The final treaty of peace made Trent and the entire Trentino district again a permanent part of Italy. Trent is situated on the Adige River midway between the Swiss border and the Gulf of Venice. Above the city rises for 308 feet a great rock crowned by a fortress, which forms part of a strong system of mountain defenses. The strategic importance of the city is due to the fact that it commands the road from Italy over the Brenner Pass, one of the chief avenues to Austria. It was the Italian objective in the early campaigns of the war. On May 31, 1915, the Italians were within ten miles of the city, but the campaign was not pushed with vigor. An Austrian offensive, begun in the Trentino on May 14, 1916, drove the Italians seven miles back into Italy.

Trent has always been thoroughly Italian and its inhabitants speak Italian only, despite the long Austrian rule. In Roman times it was the capital of the Tridentini, and was a station on the Roman road over the Brenner Pass. When the barbarian invasions overwhelmed Rome, Trent was held during the 5th century by the Ostrogoths, and in the 6th by the Lombards. After the Frankish conquest of the region in 774, Trent became part of the kingdom of Italy. In 1027 occurred the event which fixed the character of Trent's history from that time until the present. The German king, Conrad II, was given the Lombard crown in 1026 and was crowned Holy Roman Emperor in 1027. Among the many redistributions of land he made was the conferring of temporal power over Trent to its bishop. The rule of the city remained in the hands of the long line of bishops until 1803, when it passed to Austria. The Austrian régime continued, with only one break during the Napoleonic era, until its ending as a result of the World War.

Trent was the scene from 1545 to 1563 of the famous Council of Trent called together to define the doctrines of the Roman Catholic church on points raised by the Protestant Reformation. Population, about 30,000.

TRENTON, N. J. The nearness of Trenton, capital of New Jersey, to the coal fields of Pennsylvania and the great markets of New York and Philadelphia, and the excellent transportation facilities furnished by the Delaware River, a canal, and several important railroads, make it an important manufacturing center. With its 48 potteries it is the greatest pottery center of the United States. Its wares are famous the world over; every grade of goods, from bathtubs and sanitary earthenware to fine china and porcelain (including "belleek" china) is made here. Trenton is a center for iron and steel industries, and its wire and cable mills are among the largest of their kind. There are also more than a score of factories manufacturing rubber goods, and extensive linoleum works. Automobiles and incandescent lamps, silk and woolen yarn, worsted cloth, and hosiery are other important products.

The city is regularly laid out, with attractive residence quarters. In addition to the state capitol it has a large number of notable public buildings. A fine old relic of colonial times is the famous stone barracks erected by the British in 1758 as a protection in the French and Indian War, which has been restored and stands near the state house. A monument bearing a statue of Washington marks the spot where, after the historic crossing of the Delaware, Washington surprised the Hessians at their Christmas festivities and took almost 1,000 prisoners (Dec. 26, 1776).

THE "WAKE-ROBIN"

The Trillium gets its nickname from the legend that these early spring flowers awaken the robin's song.

The commission form of government was adopted in 1911, with all employees under civil service. A school of industrial arts and a state normal school are among the educational institutions.

The settlement of Trenton was begun in 1680 with the location of a mill at the rapids in the Delaware River. The city is 34 miles from Philadelphia and 56 from New York. The present name superseded the earlier one of "The Falls" in 1719 in honor of William Trent, chief justice of the colony. Population, about 120,000.

TRIESTE (*trē-ĕst'*), ITALY. Once Austria's seaport, but given to Italy as part of *Italia Irredenta* ("unredeemed Italy") in 1919, Trieste flows in twisting, turning, stairlike streets down the steep slopes of its encircling hills to the blue Adriatic, at the head of which it stands. Above are an old castle and a labyrinth of little streets, in which the peasant and the merchant classes dwell, in true Italian fashion, behind barred windows. Young and old, bareheaded always and in gay colors, move about all day in these noisy canyons, full of life and animation. Along the Corso, just below, the industrial and commercial artery of the city, are the banks, consulates, and shops.

A turn down any cross-street brings you at once upon more modern Trieste, spreading along the curving shore, a region of palaces, theaters, sunny squares, and green gardens. Here are the museum of Roman remains and the Tergesteo, a vast arcaded structure which houses much of the commerce and shipping of Trieste. Here, too, are the newspaper and insurance offices, and a café where all Trieste stops, at the breaks in its busy day, to read the news of the world from papers in a dozen languages. Three-fourths of the people are Italians. Slavs and Germans are next in importance, with many Greeks, Armenians, Albanians, and Turks, giving the city a cosmopolitan air.

Trieste is the most important city on the Adriatic, with a vast harbor, extensive shipyards, factories, iron foundries, petroleum refineries, etc. It was once a Roman colony, and passed into the hands of Austria in 1382. Population, about 230,000.

TRILLIUM. These white blossoms are popularly known as the "wake-robin"; a pretty legend tells us that, because they are among the first of spring, they are the flowers chosen by Mother Nature to wake the robins into song. The name trillium (from the latin word *tres*, meaning "three") arises from their three flaring pointed petals, alternating with an equal number of green sepals. The plant belongs to the lily family, and there are several species. These include the early or dwarf trillium, which often thrusts its white flowers through the melting snows; the large white trillium,

which is scentless; the nodding trillium whose flowers are white or pinkish white and delicately scented; the painted trillium, which has waxy white petals striped with pink; and the red or purple trillium, whose flowers have a disagreeable musty odor. The trilliums are found from Canada to Florida, growing in the cool shade of the damp, rich woods, and blossoming in April, May, or June. Scientific name of common or "nodding" trillium, *Trillium cernuum.*

TRINIDAD. A great gloomy lake of bubbling asphalt a mile across and three miles around, constantly renewing itself from mysterious subterranean depths —a lake torn out of Dante's own inferno and cast upon what is perhaps the crater of an extinct volcano—this is the famous Pitch Lake of Trinidad, which gives the United States over three-fourths of its asphalt supply. (*See* Asphalt.)

Trinidad, which except for Jamaica is the largest of the British West Indies, is located six miles east of the Venezuela coast just off the mouth of the Orinoco River. Northeast of Trinidad is the island of Tobago, both islands constituting the British colony of Trinidad and Tobago. Trinidad is a land of fertile rolling plains, high wooded hills, occasional mountain peaks (Tucuche Peak, 3,100 feet, is the highest), many deep ravines, and small rushing streams. The chief exports of the island are cacao, sugar, molasses, rum, asphalt, and petroleum.

One-third of the inhabitants are coolies from the East Indies, the rest being persons of mixed European and African blood, and a small white population made up largely of English, French, and Spanish. While English is the official language and is spoken in the towns and in several of the country districts, there are a number of cacao-growing regions in the north where a French patois is heard, and here and there Spanish is still used.

The climate of Trinidad is typical of the West Indies regions except that the wet and dry seasons are regular and that there are no hurricanes. The capital of the colony is Port of Spain, which has a population of about 70,000 and is one of the finest towns of the West Indies.

Trinidad was discovered by Columbus in 1496. It remained a Spanish possession until 1797, when it capitulated to a British force; it was ceded to Great Britain by the Treaty of Amiens in 1802. Population, over 385,000.

TRIP'OLI (LIBYA), AFRICA. Surrounded on three sides by the burning conquering sands of the great Sahara Desert, and gasping toward the north for the cooling moisture of the Mediterranean, which washes its one thousand miles of shore line, Tripoli, the Italian colony in North Africa, is a land with a great past and with hopes for a great future. Its present story is one of bitter and stubborn struggle against the barren wilderness, and against lawlessness and disorder born of ages of misrule.

For centuries Tripoli owed its prosperity to the historic caravan routes which converged here from the Sahara Desert. The most important of these were the routes to Timbuktu in the southwest, to Lake Chad in the south, and to the Darfur region of the Egyptian Sudan. Today the trade in ivory, gold, ostrich feathers, rubber, etc., which formerly flowed over these routes, has mostly been diverted to Egypt on the east and Algeria and Tunis on the west.

After a war with Turkey in 1911–12, Italy gained possession of this great territory and officially gave back to it the ancient Greek name of Libya. During the World War of 1914–18 it was overrun by Arabs, Turks, and Germans, and after the Turks and Germans gave way, the fierce wanderers of the desert continued to defy the Italian government. It was not until April 1919 that an armistice was signed which, for the first time, gave Italy a chance to organize the civilization and development of her newly acquired "empire of sand."

Once the Seat of Culture

Before the dawn of history this region, which surrounds the only great dent in the north coast of Africa, was the seat of a flourishing culture. All that is left of this early civilization is a number of great stone monuments—cells cut from the living rock, circles of rough columns, altars, pyramid mounds, and countless other signs of busy life and industry.

The earliest rulers of western Tripoli in historical times seem to have been the Carthaginians, whose capital was situated to the west on the coast of what is today the French colony of Tunis. In the 7th century B.C. the Greeks founded the city of Cyrene on the northeastern coast of Libya, and the region called Cyrenaica became one of the great centers of Greek culture. Here the sage Aristippus founded the great Cyrenaic school of philosophy, which held that "pleasure, tempered by intelligence" was the chief goal of life. Cyrenaica passed under Egyptian rule in the 4th century B.C., and later became part of Roman Africa. It was for a time a flourishing seat of the early Christian church. The name today is retained for the eastern province of Tripoli, and the village of Grenna stands on the old site of Cyrene.

Conquest by Vandals and Arabs

In the 5th century of our era Tripoli and Cyrenaica were conquered by the Vandals, and two centuries later the whole country was overrun by the Arabs, Christianity giving place to Mohammedanism. In 1510 the city of Tripoli in the northwest was captured by Ferdinand the Catholic, and from 1530 to 1551 was occupied by the Knights of St. John. Then the Turks took possession, but were never able to establish firm authority over the land.

Tripoli soon became the stronghold of pirates, and many expeditions were organized by European nations against these lawless shores. In 1801 the United States was drawn into intermittent warfare with the Tripoli pirate chiefs which lasted until 1805. In 1835 Turkey took a more firm grip on the country, but revolts continued until the clash with Italy put an end to the sultan's rule.

Tripoli or Tripolitania, as the whole region is sometimes called, has four zones. The first, along the coast, is covered with palm, olive, lemon, and other fruit trees. The second, formed by the highlands of Gebel and Tarhuna, produces cereals, dates, and figs. The Tarhuna district is particularly rich in esparto grass, used in making fine qualities of paper. The third zone consists chiefly of oases and is rich in palms. The fourth zone consists of the Fezzan and the western Libyan desert. It is a barren waste for the most part, extending with ill-defined limits toward the heart of the Sahara. In the whole colony there is not a single large river.

The richer areas of Tripoli are inhabited chiefly by Arabs, who have driven the descendants of the original Berber tribes into the mountainous districts, where they watch over their flocks and herds in comparative independence. Along the coast are many Jews, in whose hands is a large part of the country's trade. The fierce Tuaregs, the pirates of the desert, control the barren reaches of the Fezzan. In the larger seaport towns, Tripoli, Bengazi, etc., are colonies of Turks, Maltese, and Greeks, the latter largely engaged in the sponge fisheries in the Gulf of Sidra. Railway lines into the interior are slowly being built from Tripoli and Bengazi. But most of the trade is still by caravan. Area, 406,000 square miles. Estimates of the population run from 1,000,000, to 6,000,000. Population of city of Tripoli, 75,000. (For map *see* Africa.)

'A Reading from Homer', the Famous Painting by Alma-Tadema

TROJAN WAR. It was through a quarrel among the three great goddesses, so Greek legend tells us, that the war arose which resulted in the destruction of the mighty city of Troy—the war which inspired the immortal epics of the Greek Homer and the Roman Vergil, "a war so great that the sound of it has come ringing down the centuries from singer to singer and will never die."

The gods and goddesses were feasting together to celebrate the marriage of Peleus and Thetis, when Eris, the goddess of discord, who alone of the immortals had not been invited, came unbidden and threw among the guests a golden apple, on which was inscribed, "For the fairest." It was claimed by Hera (Juno), the wife of Zeus and the queen of heaven; by Athena (Minerva), the goddess of wisdom; and by Aphrodite (Venus), the goddess of love. As the strife became bitter, Paris, the son of King Priam of Troy, was called upon to award the prize of beauty. Hera promised him power and riches if he would decide in her favor, and Athena offered him glory and renown in war. But when Aphrodite came forward and whispered to him that if she were awarded the prize, she would give him the love of the most beautiful woman in the world, Paris gave her the golden apple. From that time forth Hera and Athena were the enemies of Paris and of the city of Troy.

Now the fairest of all earthly women was Helen, who was already the wife of King Menelaus of Sparta, in Greece. Under the protection of Aphrodite, Paris sailed to Greece and while being entertained in the palace of Menelaus, won the love of Helen and carried her away with him across the sea to his home on the Hellespont. Menelaus called upon all the kings and princes of Greece to help him avenge this great wrong. Among those who joined the expedition were the swift-footed Achilles, who was to win the greatest renown for strength and bravery; the mighty Ajax, the gallant Diomedes, the crafty Odysseus (Ulysses), and the aged Nestor, who was no longer

able to engage in battle, but to whom all the Greeks looked up for counsel. Agamemnon, king of Mycenae and brother of Menelaus, was chosen commander-in-chief of the Greek forces.

After two years' preparation the Greek fleet of more than 1,000 ships and an army of about 100,000 men—according to the story—assembled in the port of Aulis in northeastern Greece. But here they were detained by a calm. Seeking the reason for the delay they were told by a soothsayer that Agamemnon had killed a stag sacred to Artemis (Diana) and that the wrath of the goddess could be appeased only by the sacrifice of the offender's daughter. Agamemnon was forced to give his consent and his daughter Iphigenia was led to the altar. At the moment of sacrifice, however, Artemis, relenting, snatched the maiden away, leaving a hind in her place and carrying her away to be a priestess in her temple at Tauris.

The wind now proving favorable, the fleet set sail for Troy. The Trojans were well prepared for the conflict. King Priam, though too old to take an active part in battle, had gathered immense supplies of provisions and formed alliances with the neighboring princes and chieftains. The city was protected by mighty walls, and the Greek warriors were matched by such men as Hector, the son of Priam, by Aeneas, Sarpedon, and other valiant leaders.

For more than nine years the Greeks besieged Troy, with varying fortune. Then Achilles, the bravest and ablest of the Greeks, quarreled with Agamemnon and refused to take further part in the conflict, until the death of his friend Patroclus caused him to go forth once more to seek vengeance. But after slaying Hector, Achilles himself was killed, and the Greeks were in despair. Then the wily Odysseus advised that since they could not take the city by force, they should take it by craft. He devised the stratagem of the wooden horse, by which the Greeks succeeded in taking and destroying the city.

The traveler today may still see the ruins of "the topless towers of Ilium," as Troy was also called. They stand near the coast of Asia Minor, looking across the famous narrows of the Dardanelles at the spot where they open into the Aegean Sea. Looking toward the southeast we can still see snow-capped Mount Ida, on whose lofty height, so the poet tells us, Zeus, king of the gods, sat and watched the conflict. Half-way between the shore and the mountains is a long mound about 100 feet in height, crowned by heaps of débris. This is the so-called Hill of Hissarlik, where for centuries ancient Troy lay buried.

It was long believed that no trace of the city remained, and many even thought the whole story of Troy a myth. Then Heinrich Schliemann in 1870 began to dig down into this mound, and satisfied himself—and ultimately the world—that this was the very spot where the great war was waged thousands of years ago (*see* Schliemann, Heinrich). The excavations further revealed the fact that several walled cities had stood upon this spot long before Homeric Troy. Where he had come to seek the remains of one town, Schliemann and his successors found the ruins of nine, built one upon another during a period of 3,500 years. First, men of the late Stone Age (about 3000 B.C.) built here a settlement of sun-baked brick houses. When these were beaten down by many storms and rains into a heap of mud, the rubbish was leveled off, and another city built on top of it. So through successive ages layer upon layer was added, until nine cities in all were built, the last in Roman times.

Homer's Troy was the sixth city, destroyed about the 12th or 13th century B.C. The remains of its great walls, 16 feet in thickness, and the flanking towers,which for ten years withstood the assaults of the Greeks, still stand. But the many objects, marvelously wrought of copper, bronze, gold, and silver, which were found here, have been removed to museums. (*See also* Achilles; Ajax; Hector; Homer; etc.)

The Story of the Wooden Horse

"FOR ten years we have laid siege to Troy," said Odysseus (Ulysses), thinking of his dear island-kingdom of Ithaca. "The bravest of the Greeks are dead. Still the city is not ours, and Menelaus is not revenged upon the Trojans for the theft of Helen." He shook his wise head sadly.

"Odysseus, wilt thou not devise some plan by which we can take the city? Our wives and children, with too long waiting, will grow weary. Surely it was given to thee to save us with thy great wisdom." Thus spoke Agamemnon, chief of the Greek kings.

Then Odysseus, aided by the goddess Athena (Minerva), devised the famous trick of the Wooden Horse. He had a Greek sculptor build a colossal horse of wood, big as a mountain. It was large enough to contain a hundred armed warriors within its hollow interior. Into it crept Odysseus, Menelaus, and others of the Greek heroes. The opening in its side was closed with strong bolts. Then the Greeks broke up their camp and set sail, leaving the Horse.

When the Trojans saw the ships, that had so long been drawn up on the sands of their harbor, sail away toward the island of Tenedos and disappear in the mist, there was great rejoicing, for they thought the Greeks were returning to their homes. Had not they left an image of a Horse as a peace-offering to Athena, who was angered because the Greeks had stolen her statue from Troy?

Some said this, and others argued that it was a Greek treachery, as they ran through the gates, joyful and curious, to gather about the great Horse.

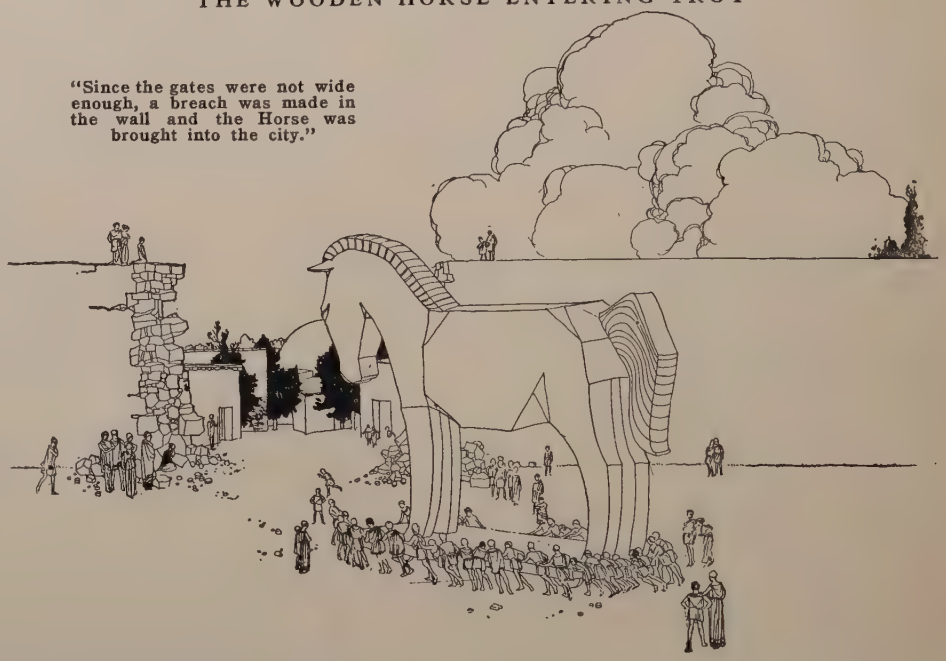
"Put no trust in the Horse, men of Troy," cried the priest Laocoön. "Whatever it is, I fear the Greeks, even bearing gifts." As he departed to offer sacrifice, he hurled his spear against the side of the Horse and there came back a hollow sound.

But his warning was drowned in the shouts of the people, as they watched the approach of some shepherds who brought a captured Greek with fettered hands. Sinon was his name, and he was none other than the trusty friend of the crafty Odysseus who had been left behind to persuade the Trojans by a guileful tale to take the Horse within the gates.

"Have pity on me," he begged. "I escaped from the hands of the Greeks when they were about to sacrifice me to the gods. The Wooden Horse was built as a peace-offering to the offended Athena. It was made of such immense size to prevent you from taking it within your gates. For then the favor of Athena would be transferred to the Trojans."

THE WOODEN HORSE ENTERING TROY

"Since the gates were not wide enough, a breach was made in the wall and the Horse was brought into the city."



Some still doubted, but a thing happened before their eyes which seemed an omen from the gods. Two huge serpents rose from the water, and, entwining themselves about Laocoön and his two sons, crushed the hapless ones to death.

"Surely this is a punishment for Laocoön's sacrilege against the sacred gift," cried the Trojans.

Since the gates were not wide enough, a breach was made in the wall and the Horse was brought into the city. That night there was rejoicing. All men went to sleep, secure in the belief that the gods were kind.

But while they slept, Sinon, for so it had been planned, drew the bolts from the door of this "gift to Athena" and out came the hidden Greeks. Then a fire was lighted as a signal to the ships, which had turned back to sight of land. A fair wind and a white moon guided the galleys. Soon thousands of Greek warriors swarmed in the streets of Troy.

All night the slaughter continued, and by morning only a mass of smouldering ruins marked the place where had stood the proud city. King Priam's headless body lay on the seashore. So perished the Trojans, except for the few who escaped. Helen, for whose sake the dreadful years of war had been waged, was again in the arms of her husband, Menelaus, and the war-weary Greeks made ready to return to the wives and children whom they had not seen for ten long years.—*Retold from Vergil's 'Aeneid', Book* ii.

TROTZKY, LEON (born 1879). For years before the Russian czar was overthrown in the revolution of 1917, Leon Trotzky had been a "man without a country." His real name was Leon Bronstein, and he was born in the Jewish quarter of Odessa in 1879, but in 1900, and again in 1905, he was imprisoned for taking part in revolutionary activities. Shortly after the latter date he fled from his native land. Paris, Vienna, Switzerland, and the Balkan states knew him as an agitator who preached Socialist doctrines, and lived from hand to mouth on the slender earnings of his bitter and sarcastic pen.

The spring of 1917 found him in New York City, where for a few weeks he had been one of the editors of the Russian Socialist paper *Novy Mir*. News of the czar's overthrow sent him hurrying to Russia. Interned for a month in England, he arrived in Petrograd when Alexander Kerensky was just rising to the head of the provisional Russian government.

Trotzky at once associated himself with Nikolai Lenin, leader of the Bolshevist faction. The newcomer's fiery oratory, his tireless energy, his relentless preaching of the most extreme measures, soon brought him to the fore in the Bolshevist movement. When Kerensky was overthrown in November 1917, it was Trotzky who walked into the Smolny Institute arm in arm with Lenin, to take over the government of Russia in the name of Bolshevism. First he was minister of foreign affairs, under Premier Lenin, and then minister of war. Under his guidance were

formed the famous "Red Armies," which defeated one by one so many reactionary military attempts to overturn the Bolshevist government. He was the chief man of action of Soviet Russia, as Lenin was its prophet and theorist.

TROUT. By universal consent the trout are considered the handsomest and finest of the smaller game fishes of the streams and lakes of the North Temperate Zone. There are two general groups—the "char" or true trout, which include the lovely brook or speckled trout, the Dolly Varden, Arctic trout, the blueback, the brown trout of Europe, etc.; and the salmon trout, which include the large-sized lake trout (Mackinac trout), one of the most important food-fishes of the American Great Lakes. The beautiful rainbow trout of the Pacific coast is an intermediate type; while the rare grayling is nearer akin to the salmon—which indeed belong to the same family, the *Salmonidae*.

All the American char except the Dolly Varden and three Arctic species are natives of the waters east of the Mississippi. The brook trout is the most widely distributed. It is also the most beautiful of the char, with a mantle of rose and violet which leads anglers to speak of "the bloom of the trout." The Dolly Varden trout is found in waters west of the Rocky Mountains. It is a large and gaudy species and makes good food, but is not so gamy as its eastern relatives. (*See* Fish.)

TROY, N. Y. Miles and miles and miles of collars, millions of dozens of them—this but vaguely suggests the yearly output of Troy, the "collar capital" of the United States and the original home of the steam laundry. A large community of collar and cuff and shirt makers has grown up in this bustling city on the Hudson that manufactures 90 per cent of all the collars worn in the United States. The trade descends from father to son and grandson, from mother to daughter. Special machines and motors are made for them in Troy, and some of the many thousand workers do their stitching at home.

Troy's excellent water-power from a Hudson River dam and from falls on two rapid streams, the Wynantskill and Poestenkill, and its good railway and steamship connection, aid in making it one of the chief industrial cities of the state. It has hundreds of factories and is the country's leading city in the production of laundry machinery, valves, bells, engineering instruments, and of the famous machine-made horseshoe invented by Henry Burden.

The city stretches for several miles along a narrow strip of land beside the river and back a mile or so eastward to some 500-foot hills—its chief residential section. It is noted educationally for its Rensselaer Polytechnic Institute—the oldest engineering school in the country—and for the Emma Willard School, which is one of the oldest schools for women in the United States, and for Russell Sage College of Practical Arts, which trains young women for practical and professional occupations.

The population, made up largely of Irish, Germans, English, Italians, and Russians, is over 75,000, but the nearby communities give the urban district a population exceeding 130,000.

TRUMPET-VINE. Dainty humming-birds hover in numbers about the clustered orange-red trumpet-like blossoms of this luxuriant vine that clambers over fences and finds its way up our porches and trellises. The plant grows very rapidly and to a great height. It climbs by means of aerial rootlets and the main stem clings tightly to its support, but the light sprays of flowers and foliage float free in the breeze. The trumpet-vine grows wild in the fields and moist woodlands of eastern and southern United States, where it blooms profusely from June until late September.

Scientific name, *Tecoma radicans*. Flowers 3 to 4 inches long and 1½ inches across, borne in terminal clusters; calyx 5-toothed, thick, slightly curved; corolla trumpet-shaped, bordered by 5 rounded lobes; 4 stamens. Stem woody. Leaves opposite, about 2 inches long, oval, pinnately compound, coarsely toothed.

TRUSTS. "If I haven't efficiency enough to beat my rivals, then the thing I am inclined to do is to get together with my rivals, and say: 'Don't let's cut each other's throats; let's combine and determine prices for ourselves; determine the output and thereby determine the prices; and dominate and control the market'." This is Woodrow Wilson's description of the way a trust is formed and it contains all the essential features of the giant business organizations which we call "trusts": combination, control of the market, determination of output and of price.

The trust in this sense is an American institution which has its parallels in other countries in this "Age of Big Business." It was begun in 1879 by the Standard Oil Company, which formed a combination with a number of other corporations. The combination was effected in this way: The stockholders of the different companies entering the combination "signed over" their stock in trust to a Board of Trustees, but without the right to demand the return of their stock. Thus a small Board of Trustees held the power to control all the combining companies. The stockholders were given receipts or trust certificates in return for their stock and the dividends earned by the company were paid upon these receipts or certificates. Because these companies combined by putting their stock in the hands of trustees the combination was called a "trust."

Other companies followed the lead of the Standard Oil Company, and in the next 25 years more than 300 trusts were formed. Most people think that all trusts make large profits, but the truth is that about half of those formed have resulted in business failures. A few of them, such as the Standard Oil Company, the Tobacco Trust, the American Sugar Refining Company, have been abnormally successful and it is from these few that most of us get our impressions of trusts.

It was the use that some of these organizations made of their wealth that first called the attention of the public to the evils of such trusts. These giant business monsters used their power to ruin their pigmy competitors and force them out of business. Then they could limit the supply of the commodity in which they dealt and fix the price at almost any figure they pleased. The price they set was the one which would give them the greatest profits and it was almost always higher than the price would be if they had competitors.

At first the different states tried to solve the trust problem. But as soon as a trust was dissolved in one state it formed a new kind of combination in another. One corporation might buy the business of the other companies and so make one huge corporation. This was the way the United States Steel Corporation, the largest corporation in the world, was formed. In other cases a new company was formed to take the place of the board of trustees in the trust. This organization, known as the "holding company," bought the majority of the stock in the smaller corporations and so controlled them in the same way that the trustees had done. In still other cases the same men owned stock and were made directors of all the companies in the combination and so secured unity of action. This is known as the "interlocking directorate." In popular usage, however, the name "trust" has come to be attached to any of these business organizations which are so large that they virtually control the market.

Present-Day Forms of "Trusts"

It is only in this popular sense that "trusts" exist in the United States today, for combinations such as that formed by the Standard Oil Company have been declared illegal. So also have holding companies, interlocking directorates, and any other form of organization which acts "in restraint of trade." These have been illegal since 1890 when the Sherman Anti-Trust Act was passed. But the law was not enforced until after 1900. Then the courts dissolved all combinations, but under the law against trusts passed in 1914—the Clayton Act—they dissolved only those which used unfair methods of competition to control trade or which fixed prices within the country, for combinations to control foreign trade are allowed. How, you inquire, do they find out about these unfair methods? By the Federal Trade Commission which is appointed just for that purpose. (*See* Federal Trade Commission; Wilson, Woodrow.)

The public now recognizes that size is not the chief evil of the trust problem. One big corporation may do the work better than a dozen small ones could, because it can hire better men, buy better machinery, save where competition duplicates and wastes, etc. It is only when it uses its size and power to hurt others that it should be suppressed. Slowly it has been recognized that trusts have possibilities for good as well as evil. The present tendency is rather toward regulation than toward complete suppression.

In the technical legal sense, a trust is a property interest held for another's benefit. It is generally regarded as an outgrowth of the feudal system of land tenure. Under this system, if a landholder's heir was a minor, the land passed under the control of the overlord until the heir came of age. Under the provisions of feudal law the overlord could, and frequently did, despoil the land; and the heir also had to pay a considerable fee to obtain his inheritance. To avoid these hardships, the custom grew of transferring or bequeathing the ownership of the land "in trust" to an adult, with the proviso that he administer it for the benefit of the heir, and transfer ownership when the heir came of age. Since the new owner was an adult, the overlord could not claim his feudal rights; and the chancellor and later the chancery courts protected the heir, called the *cestui*, against any abuse of trust by the "trustee." The device found many other uses, and survived although fought bitterly by overlords and some British kings. It now finds wide use as a means of administering estates, funds for charitable institutions, and the like. A "trust company" or a "trust and savings bank" is an institution which in return for a fee will accept and administer trusts. It will manage property and invest funds, under strict safeguards provided by law, and turn over the income to the appointed beneficiary.

TSCHAIKOVSKY (*chī-kŏf' skē*), PETER ILYITCH (1840–1893). Savage gaiety and profound melancholy, strange varied rhythms and a taste for strong color,—all these national traits of the Russian people are represented in the music of Tschaikovsky, Russia's greatest composer.

The son of a mining engineer, he was born in the iron mining town of Votkinsk, in the Ural Mountains, just at the time when Russian musicians were working to establish a national music. Although he first studied law he was always an enthusiastic lover of music, and at 21 he began the serious study of that art in the conservatory of music in St. Petersburg (Petrograd). Five years later he was graduated with honors and was appointed professor of harmony in the Moscow conservatory. His operas, produced during the next ten years, were unsuccessful, and his orchestral compositions were received with indifference. This fact, with hard work and personal troubles, caused a serious break in health and led to his retirement from teaching.

Tschaikovsky's fame as a composer came late in life and was due mainly to his orchestral music. His ballets 'Sleeping Beauty' and 'The Nut-Cracker' and his 'Pathetic Symphony' are, in foreign lands, the best known of his compositions.

TSETSE (*tsĕt'sĕ*) **FLY.** One of the greatest scourges of man and animals in the tropical regions of Africa is this blood-sucking fly, a little larger than our common housefly. By its bite tiny parasites are introduced into the blood of its victims. These parasites produce the dreaded sleeping sickness in man, and in cattle, horses, dogs, and other domestic animals they cause the disease known as *nagana*. Hundreds of thousands of natives have died of sleeping sickness, which is so called because the victim in the last stages falls into a *coma* or sleep which ends in death. The disease has been known for more than a hundred years, but it was not until early in the 20th century that men discovered that it was disseminated by the

tsetse. Since the tsetse breeds chiefly in the undergrowth on the banks of lakes and rivers, its ravages have been greatly lessened by cutting the brush for thirty yards from the bank in the neighborhood of settlements. Recently atoxyl has been discovered to be the nearest approach to a cure for sleeping sickness in man.

The tsetse is easily distinguished from all other flies by its habit of closing the wings one over the other like a pair of scissors when at rest. The female has a remarkable mode of reproduction; instead of laying eggs she deposits single full-grown larvae at intervals of about two weeks.

THE WINGED SCOURGE OF AFRICA

The dreaded Tsetse Fly, which produces the sleep that ends in death, is only a little larger than our common house-fly. The specimen here shown is greatly magnified. If it were alive and feeding, the wings would be folded like a pair of scissors.

TUBEROSE. Once borne upon the crest of fashion, this flower has so fallen in esteem that there are now few who do it honor. There are two causes for its decline, the almost sickening sweetness of the flower and its funereal associations. The tuberose is not related to the rose, as people often imagine. The popular name is merely a corruption of the scientific name (*Tuberosa*), given it because it springs from a tuber-like rootstock. The slender stem, often three feet high, bears clusters of stiff white blossoms, and 6 or 8 sword-shaped leaves. Although a native of tropical Asia and America, it is now cultivated extensively in France, Italy, and the United States. The factories in France are said to use 80,000 pounds of tuberoses annually in the manufacture of perfume.

Scientific name, *Polianthes tuberosa*. Flowers white, waxen in texture; tube long, funnel shaped; segments are short and unequal; 6 stamens inserted on the middle of the tube; 3-celled ovary; 3 stigmas.

TUDOR. A reigning house of England which came to the throne in 1485, in the person of Henry VII, and numbered among its other members his descendants Henry VIII (reigned 1509–1547), Edward VI (1547–1553), Mary (1553–1558), and Elizabeth (1558–1603). The family traced its descent on the male side from the Welsh border lord, Owen Tudor. Its claim to the throne was based on the marriage of his son Edmund to a Lancastrian princess of the Beaufort line. The future Henry VII (known as the Earl of Richmond) was the son of this union, and the only remaining claimant of the Lancastrian line. He made two attempts to win the throne, in the second of which the last Yorkist king, Richard III, was defeated and slain at Bosworth (1485). Henry VII was crowned with the fallen monarch's crown, picked up on the battlefield. After his coronation he ended the Wars of the Roses by uniting the houses of York and Lancaster through his marriage to Elizabeth of York, the heiress of that house. The Tudor rose, which typifies this union, represents a red rose superimposed upon a white.

TULIP. No flower of our garden presents a more gorgeous spectacle or a greater variation in form and color than the tulip, which belongs to the genus *Tulipa*, and is a member of the lily family. By cross-breeding, florists have produced thousands of varieties. There are the single and double early tulips, and the taller and still lovelier late tulips that vie with the rainbow in the bravery of their coloring. The large glowing blossoms, rising above the long outward-turning green leaves, look like a stately array of brilliant-hued floral urns. Very striking are the solid-colored flowers of white, yellow, orange, bright red, or dusky purple; and very dainty and artistic are those whose petals are stained with contrasting shades. Among the latter are the flamed rose tulips of white splashed with pink, soft rose, cerise, or deepest crimson; and the feathered rose tulips, etched about the edges in the same beautiful shades. Other varieties have a ground of lemon or deep yellow, painted in like manner with dazzling hues.

The tulip is a native of Asia. It was brought into Europe by way of Constantinople about three centuries ago, and became the flower of fashion for over a hundred years. As early as 1600 Holland—even then a flower-loving country—became the center of its production, and now millions of bulbs are cultivated there each year for export. In 1634 began the "tulip mania," an astonishing craze for speculation in tulip bulbs, which were sold by weight like diamonds, sometimes hundreds of dollars being paid for a single bulb. Admiration for the flower and interest in its culture were secondary matters in this wild gambling, which lasted for four years. Today the wide popularity of the tulip is largely due to the fact that its masses of dazzling color decorate our parks and gardens while most of the other vegetation is yet in the bud.

TULIP TREE. This tall slender tree, crowned by a cone-shaped mass of glossy bright green leaves, is one of the most magnificent of forest trees. In spring its large brilliant tulip-shaped flowers of greenish yellow streaked with red and orange are an added beauty. The tree has been known to reach a height of 190 feet, though it ordinarily grows from 70 to 100 feet. It is easily recognized by the unique shape of its leaves and their peculiar manner of developing. As in

many other trees, the leaf-buds are composed of scales that grow with the growing shoot; what is unusual is that each pair of scales develops so as to form an oval envelope which encloses the young leaf and protects it against changing temperatures until it is strong enough to bear them without injury. At that stage the bracts separate and the tiny leaf comes out carefully folded. As it matures it unfolds into a broad four-lobed leaf, peculiarly cut off at the apex, giving it a square appearance across the top.

THE TULIP TREE, ITS LEAVES, BUDS, AND SEED

You can always recognize the Tulip tree among the other tall residents of the forest by its leaves and its leaf buds, which, like a pair of little hands, enclose and protect the young leaves against changing temperature until they are old enough to take care of themselves.

The tulip tree is never abundant, and it is seldom that more than a few good-sized specimens are found in an acre of forest ground. It is rare in New England and west of the Mississippi, but is found in deep loamy soil along the southern shore of Lake Erie, and on the borders of swamps and bottomlands of rivers westward to Illinois and south as far as Alabama and Georgia. In the West it is called a "poplar"—largely perhaps because of the fluttering habit of its leaves and because it is the source of much of the so-called poplar lumber used for the interior finish of houses, coffin boxes, wooden ware, etc. The color of its wood has also given it the name whitewood; among early settlers it was called canoewood, because the Indians so habitually used its trunk for their dugout canoes.

Scientific name, *Liriodendron tulipifera* (Magnolia family). Bark brown, furrowed, aromatic, and bitter. Wood light yellow to brown; sapwood creamy white; light, soft, straight-grained. Leaves, alternate, simple, feather-veined; 5 to 6 inches long, growing on long slender angled petioles; they turn bright yellow in autumn. Flowers 6 inches across, solitary, erect, cup-shaped, blooming in May.

TUNGSTEN. Until a few years ago tungsten was the ugly duckling of minerals. Prospectors threw away as worthless the black-streaked rocks which contained it. Today this comparatively scarce element is in such demand that its ores have sold for as much as gold ores.

The properties that make tungsten so valuable are (1) exceedingly high melting point, (2) hardness, and (3) toughness. When it is alloyed with steel in the proportion of 16 per cent or more, it gives these qualities to the alloy. Tools made of tungsten steel cut machined steel five times as fast as can be done with ordinary carbon steel tools, holding their temper while running at a speed so high that a cigar can be lighted from the white-hot point (*see* Alloys). Nearly 90 per cent of our tungsten goes into these high speed tools. Most of the rest is used for the filaments in electric lamps of the familiar mazda type, which give three times as much light with the same current as the old carbon filament lamp. Tungsten also forms an alloy with aluminum, known as partinium, which is very light and tough and is used in automobile construction.

This immensely valuable element is harder than steel—so hard, indeed, that it will cut glass—insoluble in acids, never rusts, and has a tensile strength a third greater than the strongest steel. A thread of tungsten wire, so fine that it can hardly be seen, is as strong as a copper wire ten times its size.

The problem of getting tungsten into wire form was for many years a baffling one, for it resisted such high temperatures that it was difficult to fuse in large amounts, and it was too brittle to be rolled and drawn. The feat was finally accomplished in 1912 by reducing tungstic acid by hydrogen and molding the metallic powder into a bar by pressure. This is raised to white heat in the electric furnace and rolled down, and the process repeated some 50 times until the wire is small enough to be drawn at red heat through diamond dies (*see* Wire).

So important was tungsten during the World War for making the high speed tools needed in the manufacture of armor plate and heavy guns that the Inter-Allied Munitions Council at Paris formed an international agreement for the pooling of all available tungsten, and the price increased more than tenfold. Fortunes were made overnight, and the mining booms in Boulder County, Colo., and San Bernardino County, Calif., were like those of the old days when gold was first discovered. The world's supply before the war came largely from Burma. The ores are known as *wolframite*, *hübnerite*, and *scheelite*.

IN THE MODERN SECTION OF TUNIS

This isn't the part of Tunis where one may see the motley life of the bazaars and listen to the Moorish story-tellers. This is the European section, notable for its substantial buildings and its broad tree-lined boulevards.

TUNIS, AFRICA. There is hardly a region on the globe that can boast so varied a history or so mixed a racial ancestry as the French protectorate of Tunis —that huge mountainous shoulder which North Africa thrusts so abruptly into the Mediterranean. Only 80 miles of open water separates Cape Bon at the tip of this shoulder from the island of Sicily, and the Mediterranean peoples have streamed back and forth across this narrow stretch since the dawn of history.

Egyptians, Phoenicians, Greeks, Romans, Vandals, Jews, Arabs, Negroes, Turks, Spaniards, Italians, and French have all had a hand in shaping the destiny of this rocky promontory. Yet none of them has ever wholly conquered it, for that most ancient white race of the Mediterranean lands, the stubborn Berbers of the Tunisian uplands, dwell there today in comparative freedom and purity of race just as they did when the earliest Egyptian and Phoenician navigators touched those shores more than 30 centuries ago.

IN OLD TUNIS

Here we are in the older part of Tunis with its narrow arched streets. The man in the foreground is a water carrier plying his trade from house to house.

There, on a projection in the Gulf of Tunis, stood ancient Carthage, and high on a hill above rose the temple of Moloch, the terrible bronze god into whose fiery mouth children were thrown, while the frenzied Carthaginians prayed for victory over Rome. On the horizon on the other side of the gulf rises a mountain chain, the last eastward spur of the Atlas range, which was the scene of so many fierce struggles between Carthage and Rome and between Rome and the Vandals (*see* Carthage). Closer at hand is the Hill of St. Louis, bearing a church to commemorate the spot where the great king of France died of the plague in 1270 during the last Crusade.

Across the plain west of the site of ancient Carthage run the remains of the great Roman aqueduct, which brought water from the mountains 56 miles away. Up near Cape Blanc, the northermost tip of the African continent, is the site of ancient Utica, founded by the Phoenicians three centuries before Carthage. This entire region is as rich in ancient Latin remains as central Italy, for this was the land first called "Africa" by the Romans, the granary of the empire, and next to Rome the most important foreign center of Roman civilization after the power of Carthage was broken, and the Numidians, as the ancient Berbers were called, had been pacified.

Here, too, the early Christian church had glorious days, made famous by the names of St. Augustine, Tertullian, Cyprian, and other great theologians. After the Vandal kingdom founded by Genseric in the 5th century had been overthrown by Emperor Justinian

contained in the Easy Reference Fact-Index at the end of this work

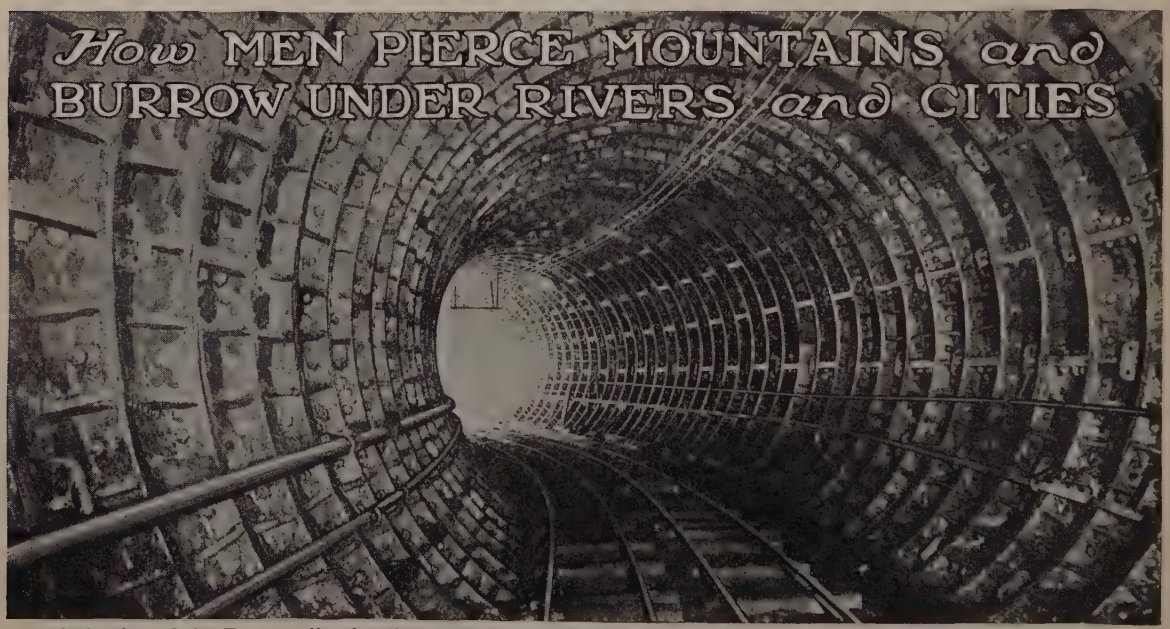
of the eastern Roman Empire in 534, the conquering Arab armies seized the land in the middle of the 7th century. Under Mohammedan rule the country rose to great power and splendor again. It became the haunt of notorious pirates and in 1535 the Spaniards under Charles V took possession of the sea-coast, after a battle with the famous corsair "Barbarossa." In 1575 the whole region passed into the hands of the Turkish Empire, where it remained, until the French, entering from the neighboring colony of Algeria, took control in 1881.

The city of Tunis, on the edge of a shallow lagoon opening into the Bay of Tunis, is the largest city of Northern Africa, outside of Egypt, and one of the most picturesque capitals of the world. The European quarter has been built up outside the old town, which retains its narrow arched streets, its mosques, its squalid market places, its crowded Jewish quarter, and all its ancient Mohammedan atmosphere. Not only are the people a mixture of all the races who have passed through the land, but the very buildings are constructed in large part from fragments of the old Carthaginian and Roman structures.

The Berbers, however, continue to till their fields and raise their flocks in the rugged valleys of the interior. Mohammedans though they are, they retain much of their ancient religion, customs, and language.

The northern sea slopes of Tunis are covered with fertile wheat fields and orchards rich with fruits. The drier eastern coast is noted for its olive groves; the central table-lands provide pasture for herds of cattle, sheep, and goats; and to the south on the borders of the Great Sahara Desert nomad Arabs raise dates in abundance, and irrigate large tracts with the waters of numerous hot springs. The land is rich in lead, zinc, iron, manganese, and phosphates.

Next to Tunis, Sfax at the north end of the Gulf of Gabes, and Susa on the Gulf of Hammamet are the most important cities. Inland from Susa lies Kairwan, the leading "holy city" of the Mohammedans in Africa. The Bey of Tunis is still the nominal ruler of the country, but he acts under the direction of the French resident-general, appointed by the foreign office in Paris. Area of Tunis protectorate, about 50,000 square miles; population, about 2,000,000; of the city, about 275,000. (For map, *see* Africa.)



A Section of the Famous "Tubes" Running under the Hudson River between New York and Jersey City

TUNNELS AND SUBWAYS. Some of the most daring feats of engineering have been the construction of tunnels beneath rivers, through mountains, and under great cities. The streets of some of our cities are underlaid by veritable networks of such passageways. There are tunnels for sewers, gas mains, and electric wires; tunnels for aqueducts in great water supply systems; tunnels for under-river traffic, as in Chicago; and tunnels or subways for rapid sub-surface transportation, as in London, Paris, and New York, where millions of people daily whiz in roaring trains and tramway cars back and forth through serpentine "tubes." The first step in tunnel construction is to prepare a geological map showing the nature of the earth to be penetrated, the probability of encountering water, etc., for upon these difficulties the cost of construction depends largely. Then a guide line for excavating, called the tunnel "center line," is established by surveyors. Next, the difference in elevation between the two ends is ascertained; the shape and inside dimensions are decided upon, and then the

excavating begins. Open-cut tunnels are often constructed by first removing the overlying material (by open excavation if on land, or by dredging if under water), completing the tunnel structure, and then refilling over it. Open-cut tunnels are often used in constructing subways.

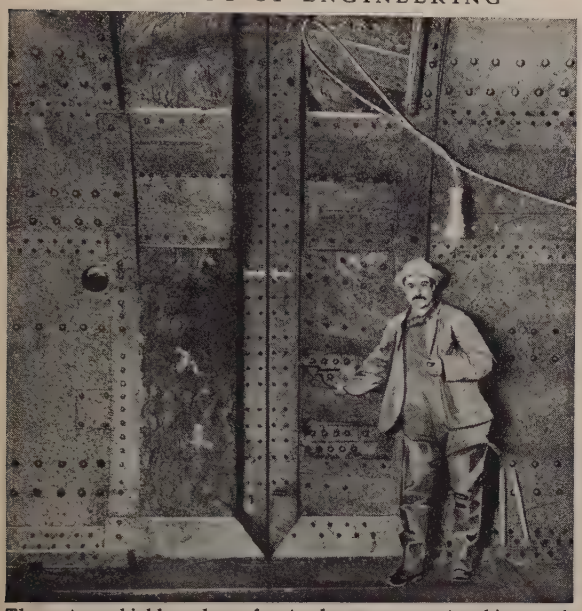
Large tunnels are seldom driven as one big hole; that is, the whole area of a cross-section is seldom removed at once. Instead, the cross-section is divided into several segments and these are started one at a time. Thus several gangs can work at once, the first gang to start always being farthest along.

The sides and top of a tunnel are usually supported by a lining, even in hard rock. Temporary lining is always set up when working in soft material, to prevent "cave-ins," and is replaced by the permanent lining as the work progresses. In such cases, the first structure is of timbers and cross-timbers. The permanent masonry —brick, stone, or concrete—may be from one to five feet thick, the greater thickness being used in such soft heavy material as wet clay and sand. Cast iron lining is sometimes used, particularly in tunnels at considerable depths below the surface of water. The iron is made in cylindrical sections from two to six feet long and one or two inches thick, and these are bolted together when put in place. Sometimes they are further lined with masonry.

Small dump or tram cars carry out the excavated material. Often vertical holes or shafts, braced with timber, are sunk from the surface so as to attack the excavation from additional points, the work being extended both ways from where the shaft is sunk. Men, materials, and tools are raised and lowered through shafts in power elevators. Sometimes the shafts are filled in again after the work is completed; sometimes they are left permanently for ventilating the tunnel. Occasionally the digging of a tunnel starts at each end, the workmen meeting in the center. In the Rogers Pass tunnel, British Columbia, a small "pioneer tunnel" was driven first. "Side-cuts" were then made and gangs worked from their ends to build the main tunnel.

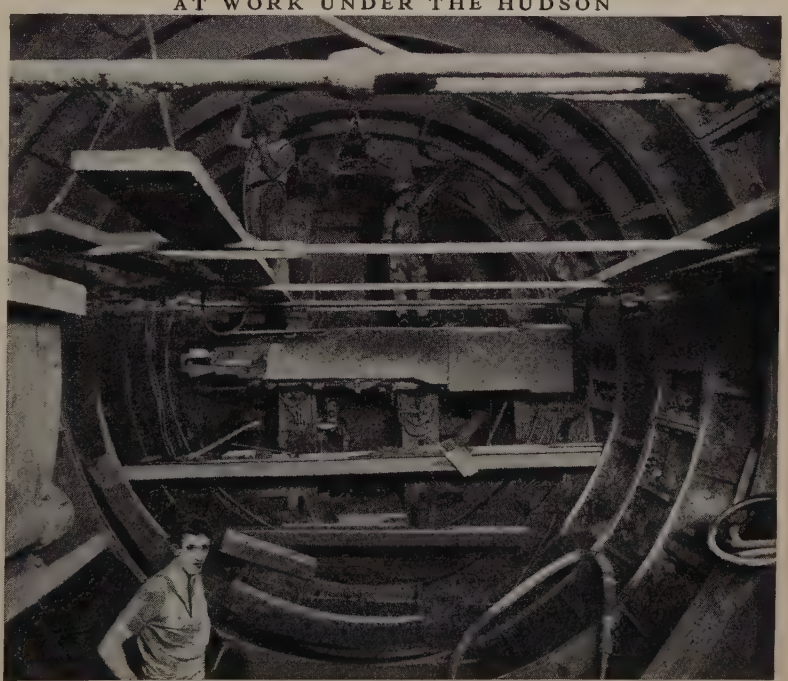
Hard rock is the easiest material to tunnel through, as it is easily broken up by blasting, and the masonry lining may usually be completed without much timbering. Submarine tunneling is more difficult. If the water which seeps down into the excavation cannot be kept out by pumping, use must be made of compressed air, or a *shield*, or both. The shield, one of the most valuable of engineering inventions, is a steel-plate cylinder or shell, from 6 to 30 feet in

A PRODIGY OF ENGINEERING



These two shields, whose front edges you see touching each other at the center, have been driven under the river from opposite directions with such marvelous accuracy that they met squarely and in perfect alignment. This feat was accomplished in making one of the railroad tunnels under the North River between New York City and the New Jersey shore. Failure would have meant an enormous extra expense.

AT WORK UNDER THE HUDSON



Here we are within a shield watching the "sand-hogs" at their work. At the forward end you see the bulkhead through openings in which excavated material is removed. When the men are digging, compressed air is forced into the shield at high enough pressure to keep the water from entering.

length and 40 to 80 tons in weight, inside of which the excavation and the construction of the tunnel lining are carried on. Thus the inrush of water and soft material during the excavation is prevented. Inside the shield is a vertical bulkhead partition or diaphragm with openings whose doors can be quickly closed if necessary. Through these, laborers excavate the material in front of the shield, taking it out in the rear. The forward end of the cylinder is a strong cutting edge; and as the digging proceeds, the shield is thrust forward into the soft earth by the power of hydraulic jacks; and the tunnel lining is constructed within the rear of the cylinder, the latter always overlapping the completed lining by several feet. In the compressed air system the end of the tunnel where the digging is going on is filled with air under sufficiently great pressure to keep water from entering.

A method much used in the United States at small depths under river bottoms consists in constructing cylindrical steel sections, closing their ends with wooden bulkheads, then floating them into position and sinking them into a trench dredged in the river bottom. The sections are successively joined and lined with concrete inside and out. This was the system used in the tunnels built under the Harlem River for the New York subway tracks.

Tunnel building is one of the oldest of engineering operations. It was practiced by most ancient peoples, including the Egyptians and natives of India, who built them for tombs and temples; the Assyrians, and even the Aztecs in America. All work was done by hand and so was infinitely slow and laborious. The Romans, the greatest of ancient engineers, developed the scheme of sinking shafts to afford additional digging points, and the "fire-setting" method—heating the rock by fires and then suddenly chilling it with water to crack it. Vinegar was often used, and thus chemical action hastened disintegration. The Roman tunnels were built chiefly for their celebrated aqueducts and highways. During the Middle Ages tunnels were built for military purposes. Every great castle had its underground passage for escape.

Canal construction in France and England in the latter half of the 17th century stimulated tunnel building, but it was not until after 1800 that tunneling through sand and wet ground was extensively undertaken. The greatest stimulus to tunnel building came with the railroad era.

THE WORLD'S MOST FAMOUS TUNNELS

THE Mont Cenis tunnel through the Alps, nearly eight miles long, was the first to link Italy and France. The work took 13 years, from 1857 to 1870, and cost $15,000,000. It was bored simultaneously from both ends, and the engineering work was so accurate that the two halves joined at the center with almost no error.

The St. Gotthard tunnel, at the very heart of the Alps, nine and one-fourth miles long, was eight years in building, 1872 to 1880; it cost $11,500,000. The railroad approaches up the steep mountains at both ends are themselves marvels of construction, the trains passing through a series of 100 tunnels in all winding about in spirals through the bowels of the mountains.

The third Alpine tunnel, the Simplon, twelve and one-third miles long, is one of the greatest of all engineering achievements. Vast difficulties were encountered in construction, including terrific underground heat, and floods of subterranean hot and cold springs. Construction took from 1898 to 1905 and cost nearly $16,000,000.

The subway for foot passengers under the Thames at London; built 1825–43.

The longest tunnel in North America is the Gunnison, in southwestern Colorado, six miles in length. The Rogers Pass tunnel, in the Selkirks in British Columbia, is five miles long. The Hoosac tunnel, in Massachusetts, four and three-fourths miles long, was under construction intermittently from 1855 to 1876, and cost $11,000,000.

New York City surpasses all other cities in the number of tunnels and subways which honeycomb its site. More than a dozen great underwater tubes provide communication between Manhattan Island and the neighboring islands and mainland, and a network of subways links all the principal points throughout the whole metropolitan area.

TUNNY. If an artist were asked to paint a picture of an ideal fish, for beauty, strength, and speed, the picture would probably resemble closely the great leaping tunny, the king of all ocean game. This fish, also called the "tuna," the "horse mackerel," and the "giant albacore," is the largest member of the mackerel family; and it has a record length of more than ten feet and a weight of 1,500 pounds.

From his sharp nose to the slender base of his tail, the tunny swells out and tapers again in almost perfect curves. His body, indeed, has provided a natural model for the builders of the fastest racing yachts. Driven by his powerful tail fins, he flashes through the waves with the speed of an arrow, frequently hurling himself out of the water and seizing the swift flying-fish.

Tuna fishing is the most exciting sport of the Pacific coast. Amateur fishermen put out to sea, in powerful launches, with trolling lines baited with a big flying-fish, the favorite food of the tuna. "Suddenly the fish strikes like a living meteor," says a well-known writer on game fishes. "A mass of white foam leaps upward. There is a blaze of silver, then loud musical notes, *z-e-e-e-*, *z-e-e-e-*, rise on the air as the big reel gives tongue, and the fight is on. The tuna turns and rushes seaward, tearing at the line—taking feet—yards—and has 500 feet of line perhaps before the boatman has his boat under sternway; and then begins the contest, ranging, according to individuals, from 10 minutes to 14 hours."

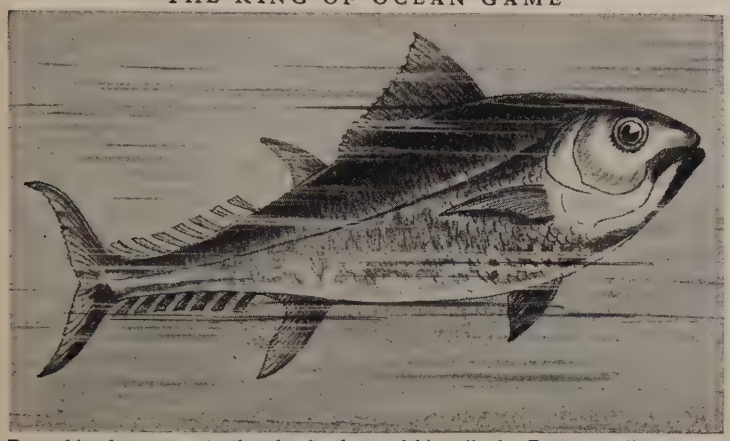
Fishing boats are often towed 12 or 15 miles by a tuna weighing no more than 150 pounds. On the Atlantic coast, where these fish grow even larger than in the Pacific, they are sometimes caught with hand lines, without reel or rod. On more than one occasion fishermen who became entangled in these lines have been jerked overboard and drowned.

The European tunnies are caught in nets shaped like a funnel, the fish entering the wide end and being driven to the narrow end, where they are killed with lances and harpoons. Near Constantinople tunnies appear in shoals so crowded that they are often taken by hand. Tunnies preserved in oil are preferred in southern Europe, and this industry has become highly important in the Mediterranean.

In the United States great quantities of tunny are used under the name "tuna fish." About $2,000,000 worth of this product is canned every year.

An important discovery was made through the tunny in 1839, when John Davy, brother of Sir Humphry Davy, found that the temperature of this fish's blood was considerably higher than that of the water in which it lived. This disposed of the time-honored division of vertebrate animals into warm-blooded and cold-blooded.

THE KING OF OCEAN GAME



From his sharp nose to the slender base of his tail, the Tunny swells out and tapers again in almost perfect curves. Driven by his powerful tail fins, he flashes through the waves with the speed of an arrow.

Closely related to the tuna are the common albacore and the bonito, two smaller members of the mackerel family, found in the Atlantic and Pacific. Although these are excellent game fish, they do not equal their larger relatives as food.

Scientific names of tunny or tuna, *Thunnus thynnus;* of albacore, *Thunnus alalonga;* of bonito, *Sarda sarda.*

Tupper, Sir Charles (1821–1915). "Sir Charles" was the formal title of this eminent Canadian statesman after he received the honor of knighthood in 1878, but to most of his friends and constituents in Nova Scotia he remained plain "Doctor Tupper" to the day of his death.

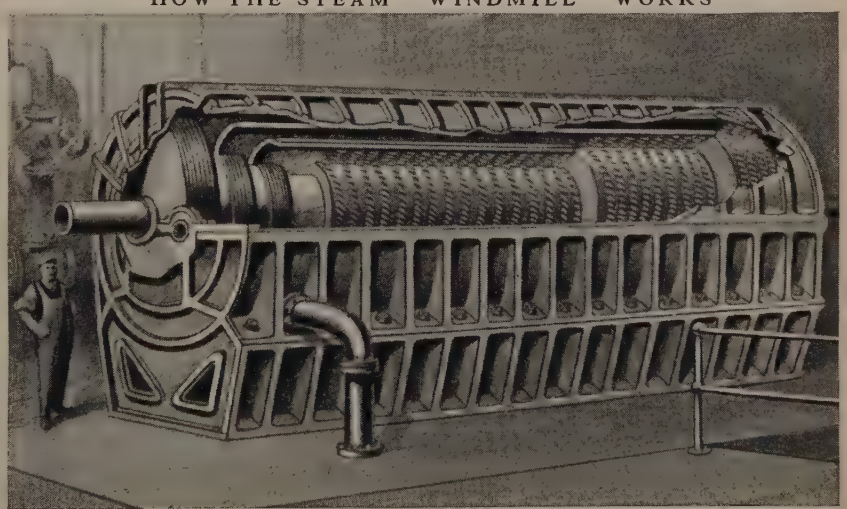
For 12 years after completing his medical studies in the University of Edinburgh, he was a country doctor in Nova Scotia. Toiling through snowdrifts in winter and rivers of mud in the spring, he here displayed the same qualities of stubborn determination and bulldog courage which later brought him to the forefront of political life. His entrance into politics took place in 1855, when he was elected as a Conservative to the Nova Scotia assembly, amazing all by defeating the idol of the Liberal party, the brilliant Joseph Howe. He at once became one of the commanding figures of his party, and in 1864 was chosen premier of the Nova Scotia province.

In this position he accomplished the work that gave him his chief title to fame; for he was one of the foremost of the group of Canadian statesmen who united the separate colonies of British North America into the Dominion of Canada. None of these leaders had a more difficult task laid out for him than Dr. Tupper in Nova Scotia. The project of union met with bitter opposition in his province, with the powerful Howe to lead the malcontents and inflame them almost to the point of rebellion. But Tupper's tireless efforts bore fruit, and Nova Scotia was brought into the federation and kept there. "If he (Tupper) had been a man of less invincible courage and determination," says Sir Robert L. Borden, "the project of Confederation might have been postponed for many years."

During his long career, Sir Charles Tupper held many high offices, doing especially valuable service in the Dominion government as the first minister of the department of railways and canals. His rise to the premiership of the Dominion, however, did not come until 1896, when he was 75 years old, and his term in that office lasted only a few months, for the Conservative party was defeated in the general elections two months later.

Turbine. Perhaps you have seen city firemen dragging their hose to a burning building. It is filled with water almost to the bursting point, but the

HOW THE STEAM "WINDMILL" WORKS

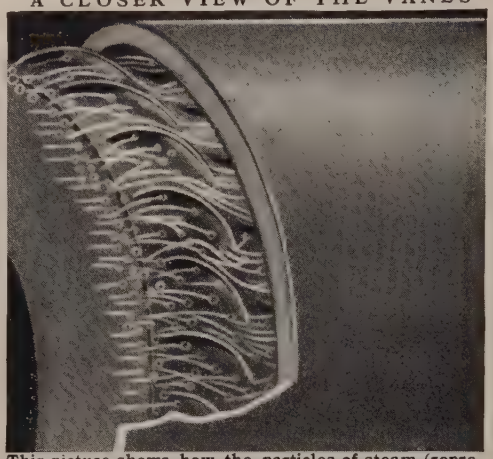


The steam rushing into the fixed cylinder of this pressure turbine strikes against those thousands of little vanes or blades arranged in rings around the big revolving shaft. The cylinder also has curved vanes attached to it to direct the steam striking against the vanes on the shaft. At the farther end the drum increases in diameter to present a greater surface to the steam as its force decreases.

nozzle is turned off. One man can hold it easily. But as soon as the nozzle is opened and the big stream starts to spurt, the hose straightens and jumps like a giant snake. Two or three men have all they can do to keep its nose turned upon the blaze.

That sudden power, which comes from the release of a fluid under pressure, is the same kind of power which is used in turbine engines, whether they be water turbines, steam turbines, or air turbines (*see* Windmills). It depends upon the momentum attained by the water or the steam. Now if you wished to use the power developed by the firemen's hose, there are evidently two ways of doing it. You could set up a wheel with vanes or wings on its rim, and direct the full force of the water as it came out of the narrow nozzle against these vanes, and the wheel would spin at great speed. This would be an example of the simplest form of turbine, called the "velocity" or "impulse" turbine.

A CLOSER VIEW OF THE VANES



This picture shows how the particles of steam (represented by the little "tailed" circles), after striking the first ring of vanes on the shaft drum, are then deflected by the vanes on the inside of the cylinder so as to strike directly upon the next ring of vanes on the drum, and so on. Thus the countless small "pushes" in rapid succession set the shaft whirling at enormous speed.

On the other hand, imagine a number of wheels *inside* the hose, all of them attached to a suitable shaft, and arranged so that the flowing water would strike them, one after the other, before it reached the nozzle. The stream through the hose would be slowed down, of course, and these wheels would not turn so fast as the one described above, which receives all at once the full force of the stream, but they would deliver a steadier and equally powerful motion. This would be an example of the "pressure" or "reaction" turbine.

There are, of course, many ways of applying these two fundamental systems, but the accompanying pictures show the essential parts of the simpler forms of water and steam turbine engines. Steam under ordinary boiler pressure has one great advantage over water—it expands in volume with tremendous velocity, often as much as 4,000 feet per second. No wheel made can revolve at anywhere near this speed, but various devices are used to "tame down" the steam, such as distributing the flow through several turbine wheels in succession. The Curtis type of steam turbine uses the "impulse" system, while the Parsons type is built on the "reaction" plan.

Water turbines are of immense value where a swift and plentiful supply of water is available. They are used for generating electricity, in pumping water for irrigation, etc. Some of the largest hydroelectric plants in the world are situated at Niagara Falls, where the vast flow is harnessed to more than a score of mammoth turbines. In the high Sierra Mountains in California where streams of water can be dammed so as to get high water pressures, impact turbines are largely used; while at Keokuk on the Mississippi, where there is an enormous volume of water under much lower pressures, the "pressure" or "reaction" turbines are used.

Steam turbines are particularly useful for driving machinery at high speed, avoiding all the jar and loss of power involved in the ordinary "reciprocating" steam engine (*see* Steam Engine). Besides driving dynamos by direct connection, they are used with great success on swift ocean vessels, such as naval destroyers and some ocean liners. The ill-fated *Lusitania*—sunk by a German submarine in 1915—was a fine example of a turbine ship.

TURGENIEF (*tur-gĕn'yĕf*), IVAN (1818–1883). It was through Ivan Turgenief that the Western world first became acquainted with Russian literature. He ranks as one of the great novelists of the world.

He was born in central Russia, into an old noble and wealthy family that had long been established on generous estates. Private tutors taught the young lad French, German, and English, for aristocratic Russians at that time considered it beneath them to speak the language of their own country. That knowledge of Russian which he used with such mastery in his books he was compelled to pick up from the servants. Later he studied at the universities of Moscow, St. Petersburg, and Berlin. His mother wanted him to follow a government career, but the young man had determined to devote himself to literature.

Because of the liberal ideas he had expressed in his writings Turgenief was exiled to his country estate for two years. At the end of his exile he left Russia never to return except as a visitor. His active life he spent in Paris, where he wrote the greater number of his novels.

On his parent's estate he saw many examples of the ill-treatment of the serfs, which he later described in his first book, 'A Sportsman's Sketches'. This book helped to stir Russian society to a consciousness of the evils of that system, and was of some influence in hastening the emancipation of the serfs in 1861. By many this book is considered to be Turgenief's masterpiece. It is full of delicate delineation of character and exquisite nature descriptions.

Turgenief's most famous novel, 'Fathers and Sons', aroused bitter controversy and caused sharp attacks against the author. The novel deals with the con-

flict between the fathers, who represent the Conservative party and believe in the rights of the nobility, and the children, who represent the Liberal party with its revolutionary ideas. The hero, a young doctor, is a "nihilist," a term which first found expression in this novel. As here described a nihilist is "a man who bows before no authority and accepts no principle unproved." He takes a negative attitude toward all institutions and throws overboard all conventions. The Liberals were furious at this representative of their party, whom they considered a caricature. The Conservatives were even more angry at what they considered a portrayal of the weakness of their party.

In all of his novels Turgenief pictures the state of Russian society, especially the Russian gentry and the various intellectual types of the period. He is both a realist and idealist. His style is delicate and charming. A wistful tenderness tinged with melancholy pervades his novels and produces the effect of strange sad music.

In Paris Turgenief mingled with the great men of the period, by whom he was loved and respected. His works were translated into French and English soon after their publication, and received favorable criticism. Turgenief never married. When he died in 1889, his body was taken from Paris to Russia, the country from which he had lived for so many years a voluntary exile.

Turgenief's chief works are (under their English titles): 'A Sportsman's Sketches' (1850); 'Diary of a Superfluous Man' (1850); 'Rudin' (1855); 'A Nobleman's Nest' (1858); 'On the Eve' (1860); 'First Love' (1860); 'Fathers and Sons' (1862); 'Smoke' (1867); 'King Lear of the Steppes' (1870); 'Spring Waters' (1872); 'Virgin Soil' (1877).

TURIN (*tū-rĭn'*), ITALY. With its broad straight streets, its beautiful buildings, its fine summer climate, and its magnificent view of the Alps, Turin is today one of the most attractive cities in Italy. It is built at the junction of the river Po and the Dora Riparia, upon the site of the ancient Roman town of Augusta Taurinorum.

From its position near the French border, directly opposite the Mt. Cenis Pass and the Mt. Cenis tunnel, Turin has gained great commercial importance. It is the fourth largest city in Italy, and is the center of the Italian automobile industry, employing more than 5,000 men in this work alone.

Since the earliest days, when the Romans took the city from the Taurini Gauls, Turin has been of great strategic importance. Realizing this, the Romans built a 21-foot wall around it, portions of which still remain. When Hannibal came over the Alps in 218 B.C. it was one of the first towns he captured.

Turin, as capital of the principality of Piedmont and later of the kingdom of Sardinia, is the nucleus around which grew the present Italian kingdom. It was the capital of united Italy from the time of the union in 1860 until 1865.

Turin has a university founded in 1400, which is celebrated today for its medical and scientific departments. The museums of the city contain many interesting relics of the early history of the region, and its art galleries have important works by Van Dyck and sketches by Raphael, Michelangelo, and Leonardo da Vinci. Turin is noted for the large number of public monuments which grace its squares.

Besides automobiles, Turin manufactures chiefly machinery, cotton, silk, leather, and chemicals. The power for its industrial plants is mostly derived from electricity generated by the nearby mountain torrents. Population, about 452,000.

TURKESTAN'. In the heart of Asia, between the Caspian Sea on the west and the Desert of Gobi on the east, north of Persia, Afghanistan, and Tibet, lies a vast region some 2,000 miles in length which has undergone strange vicissitudes. Successive peoples and civilizations here arose and flourished on what was once a fertile soil, but today their cities lie buried under the drifting sands which slowly but irresistibly have ruined the land. Life itself is gasping under inevitable doom; all the water of this country comes from the snow and ice of the mountains, and both natural and historical records show a slow drying up of the country which has advanced perceptibly in the last century.

We call this region "Turkestan" from the Turkish or Turkoman peoples; but today it has neither racial, geographical, nor political unity. It is a country of lofty mountains, desert plateaus, and desert lowlands, with some grassy steppes and still fertile river-basins, sharpy divided into an eastern and a western part by the lofty Tien-shan Mountains.

The high plateau of Eastern or Chinese Turkestan (sometimes called Kashgaria) is walled off on three sides by towering mountains, and on the fourth—the east—by the worn stumps of an ancient mountain chain. It is practically a bay of the great Gobi Desert, sprinkled with oases and sparsely watered by streams, most of which soon sink into the sand and are lost. Yarkand, Khotan, and Kashgar are among the more important cities of today, with populations ranging from 30,000 to 100,000. Administratively, East Turkestan forms part of the Chinese province known as Sinkiang or the New Dominion, which has an area between 500,000 and 600,000 square miles and a population, partly Aryan, partly Turkish, partly of mixed stock with some Chinese, of which estimates range between 1,000,000 and 3,000,000. Urumchi is the capital.

Western or Russian Turkestan embraces several divisions, including the province and city of Samarkand (the capital of Timur's empire), and the little mountain kingdom of Ferghana, whence Timur's descendant Baber was driven forth to found the Mogul empire of India (*see* Mongols). In a wider sense it also includes a larger fringe of territories—the Steppe Provinces of Russia on the north, the Trans-Caspian Province on the west and south, and also on the south the states of Bokhara and Khiva, which Russia reduced to vassalage in the 1870's.

This gives a total area of nearly 1,300,000 square miles (about six times that of France) with a population estimated at 10,000,000 (about a fourth of that of France). On the east lie the lofty valleys and snow-crowned mountain of the Pamirs, the "roof of the world," 16,000 to 18,000 feet above sea-level. To the west and north are plains, steppes, and deserts ranging from 1,500 feet above sea-level to many feet below. Hot summers, cold winters, heavy rains and snows on the mountains, almost no rain on the plains, are the general characteristics of the climate, which varies considerably from north to south as well as according to altitude. The soil is exceedingly fertile when irrigated, but not over 4 per cent is now under cultivation. Canal systems of immemorial antiquity make some of the oases "veritable gardens of Eden"; elsewhere traces of irrigation systems far from any possible existing source of water show where old centers of life have perished.

The oasis and khanate of Khiva is watered by the Amu and surrounded by trackless desert; its very existence was forgotten by the western world until plundering Cossacks in the early 17th century learned from a Khivan merchant caravan of the existence of a wealthy city across the waste. The cities of Bokhara and Samarkand are both watered by the Zerafshan, which, once a tributary of the Amu, now dies away in the sand. "Bokhara the Noble" is an ancient center of learning and religion, venerated by Mohammedans next to Mecca, and still the principal book-market of central Asia. To the western world it is chiefly famous for the beautiful Bokhara rugs that are marketed there. Samarkand, capital of the ancient Sogdiana, was destroyed by Alexander the Great, rebuilt by the Arabs into a brilliant and populous city, destroyed by Genghis Khan, and created the capital of his empire by Timur, whose splendid tomb, with those of some of his wives, still stands there.

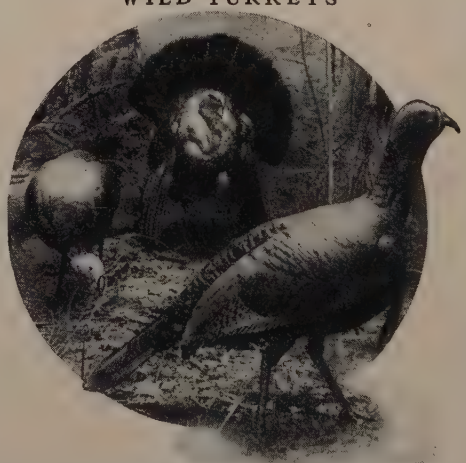
Tashkend, the capital of Russian Turkestan, is the largest of the cities, with a population estimated at nearly 275,000. Khokand, Samarkand, and Andizhan have populations around 100,000. The population is partly Aryan and partly Turkish, Tatar, and Mongol (chiefly nomadic herdsmen). Raw cotton, silk, and cattle are the principal exports. In both Eastern and Western Turkestan there are many valuable minerals—coal, graphite, petroleum, salt, asphalt, metals, and precious stones which are very slightly worked or not at all. Today Russian Turkestan is connected with the outside world both by the Trans-Caspian railway, running westward to the Caspian Sea, across which trains are ferried to Baku; and a branch of the Trans-Siberian railway, which runs northwestward from Tashkend. (For map, *see* Asia.)

The Russian Revolution of 1917 was followed by revolutionary movements throughout Western Turkestan, which in 1918 was proclaimed an autonomous republic—the first Mohammedan republic—in alliance with the Russian Republic.

TURKEY. Thanksgiving and roast turkey are synonyms in the United States. From the first Thanksgiving day of the Pilgrims, when visiting Indians furnished wild turkeys for the feast, no Thanksgiving menu has been complete without its roast turkey.

The turkey is the only American representative of the Old World pheasant family. There are several species, all having the head and neck bare of feathers. The tail is broad and round, with 14 to 18 blunt buff tipped feathers. These the male bird spreads fanwise and raises above his back in courting days. The dark plumage has metallic green, copper, and bronze reflections. The male bird has a special beardlike growth of black bristles hanging from the center of the upper breast. The call note, *turk, turk, turk,* doubtless gave the birds their name, as the cock's *gobble-gobble* has caused it to be regularly known as the "turkey-gobbler." The turkey-hen hides her nest even from the cock, as he has a habit of breaking the eggs. The hen usually lays about 12 eggs a year, and unless misfortune overtakes her first brood raises only one a year.

WILD TURKEYS



Years and years ago, if you were a skilful hunter and knew how to slip up on them, you could find groups of Wild Turkeys like this all over North America. Now they are to be seen only in great cities like New York and Chicago—in the museums stuffed and mounted.

Turkeys are cared for in much the same way as other fowls, except that they are more delicate. The young in particular must be watched, because if they get wet through running in damp grass or being caught in the rain, they often die.

Wild turkeys were once very plentiful all over temperate North America and Central America. Now they are very rare, but the domesticated turkey, the descendant of the wild species, is common in poultry yards both in America and in Europe, where it was brought from the New World early in the 16th century. The American bronze turkey, the largest of the domestic birds, is from the stock of the Mexican wild turkey; at times it attains a weight of 40 pounds or more. White, pied, and buff turkeys have also been bred with success. Scientific name of the common wild turkey, *Meleagris gallopavo.*

The OTTOMAN EMPIRE and Its CHECKERED HISTORY

View from the Galata Quarter of Constantinople across the Golden Horn to the Stamboul Quarter

"THE historie of the Turkes," wrote Richard Knolles in 1610 in his quaint old quarto volume, "is nothing else but the true record of the wofull ruines of the greater part of the Christian commonweale"; and he added that their empire was "of all others now upon earth farre the greatest." For several centuries, indeed, Christian civilization seemed to tremble in the balance before the advance of this barbaric Mohammedan power. How that menace was brought to naught and the Turkish Empire reduced to its present impotence, is sketched in the accompanying article.

TURKEY. The ancestors of the "Osmanli" or Ottoman Turks (who got their name from their early leader Othman or Osman) were barbaric pagan herdsmen when they first wandered into western Asia in the 13th century, as the result of one of those internal commotions to which central Asia was periodically subject. They belong to the Ural-Altaic branch of the Mongolian race, and were related to the Tatars, Mongols, Finns, and Magyars. Embracing Mohammedanism with fanatical zeal, they were settled by the Seljukian sultan of Iconium in northwestern Asia Minor, as a reward for military services, and soon the whole of that peninsula was under their sway. In 1354 they seized Gallipoli, on the European side of the Dardanelles. A hundred years later they were in possession of Constantinople and practically the whole of the Balkan peninsula. A century after that their armies were thundering at the gates of Vienna, in the very heart of Europe; while all Asia west of Persia, and Egypt and northern Africa almost as far as the Strait of Gibraltar, formed part of their vast and barbarous empire. The Turkish sultan had also assumed the califate, or spiritual leadership of the Mohammedan faith.

Decline of Turkish Power

Of that formidable Ottoman power, only a remnant now exists. Greece and other Balkan states made good their independence in the course of the 19th century. Algeria and Tunis were lost to France, and Tripoli to Italy. Crete, Cyprus, and other Mediterranean islands are in the hands of foreign powers. Turkish possessions in Europe, which before the Balkan Wars extended to the Adriatic Sea and covered an area of 65,370 square miles, were reduced by that disastrous conflict to less than 11,000 square miles. The faint ties which long bound Egypt to Turkey are at last severed; Arabia is under its own rule; Syria is governed by France under mandate from the League of Nations; Palestine and Iraq (Mesopotamia) are British mandates. The Ottoman power which long terrorized the western world is little more than a memory, charged with a long record of cruelty.

The Home of the Turks

The peninsula of Asia Minor or Anatolia, to which Turkish rule is now practically confined, is a historic land, which has been from the earliest times a great center of migration and a battle-ground of warring nations (*see* Asia Minor). Consisting for the most part of a high plateau sloping toward the sea on three sides, its surface is divided by mountains, which prevent an even distribution of moisture and which break up the country into many more or less isolated districts. In spite of backward agricultural methods the peasants on the Aegean side are able, aided by the fertile soil, warm sunshine, and abundant moisture, to produce an abundance for their needs of wheat, oats, and barley; as well as tobacco and cotton, grapes, olives, and figs for export. The coast of the Black Sea, exposed to northern winds and fogs, is much colder, and on account of the narrowness of the valleys there is comparatively little arable land;

but so fertile is the soil that not only grains but fruit of many kinds are produced, while the mountains abound in forests of walnut, oak, fir, box, beech, plane, and other woods. The southern coast below the Taurus Mountains is almost tropical in climate, and there olives, mulberries, pomegranates, figs, oranges, lemons, and sugar-cane are grown.

In the interior there are extremes of heat and cold and the rainfall is scanty. Much of the land is suitable only for cattle- and sheep-raising, and part of it is almost a desert. If the Turks were more energetic and progressive, almost all of this land would be fruitful; but without irrigation and proper cultivation it is only a barren waste—in part the result of deforestation in bygone centuries. There are valuable mineral resources that have never been fully developed; but Turkey as a whole is now a poor country, a land worn and torn by the strife and struggle of ages and by centuries of misgovernment. Including sections of the famous Berlin-Bagdad railway, over whose construction there was much international intrigue before the World War, Turkey now has about 2,000 miles of railroads. (For a map of Turkey, *see* Asia.)

The Land of Many Peoples

Anatolia contains a medley of many races and nationalities, which have never become welded into a unit. There are Kurds, Circassians, Gipsies, Armenians, Jews, and Greeks, and many other peoples, besides the ruling race, the Ottomans or *Osmanlis*, or, as we commonly call them, Turks. And these Turks themselves are a mixed people, due to their habit of polygamous marriage with female slaves or captives of every race, and the levying of a tribute of male children from the Christian populations to be brought up as Mohammedans and Turkish warriors (the Janizaries). Thus today the Turks are probably more Caucasian in blood than Mongolian.

A LEMONADE VENDOR

This Turkish lemonade vendor carries the water in that ornamental tank on his back, the syrup in the pitcher in his left hand, and the tray for the glasses suspended in front of him.

The men are frequently fine-looking fellows, well-proportioned and of medium stature, with aquiline noses and bright dark eyes and dark or chestnut hair. Although they possess considerable muscular strength, they are of indolent disposition. They are too proud to engage in menial labor, they lack initiative and inventiveness, and their religion (Mohammedanism) teaches a fatalism that tends to destroy effort and ambition. In war their courage and capacity for enduring hardship and privation make them excellent soldiers when properly trained and officered. Under ordinary circumstances the Turkish gentleman is dignified in bearing, honest, temperate (the use of wine is forbidden by the Koran), courteous, and hospitable. When roused to a frenzy of religious excitement the Turk becomes intolerant, cruel, and vindictive; but government policy as well as religious fanaticism lie back of the many terrible massacres of Bulgarian, Armenian, and other Christian subjects that for centuries have stained the Turkish name.

Some of the native customs of Turkey are now disappearing. Most of the men still wear the characteristic Turkish fez, but in other respects educated Turks dress much like Europeans. The women are no longer forced to veil their faces when they go upon the streets, though many of them still cling to the thin half-veil—possibly because it gives an added charm to the

WHERE DELICIOUS FRUIT IS CHEAP

For a few pennies you can buy the most delicious fruits from these Constantinople street vendors. Nowhere in the world are finer fruits grown than the oranges, melons, figs, and grapes which the rich soil of the Anatolian valleys yields in such abundance.

bright dark eyes peering above it! Although, according to Moslem law, every man may have four wives, most of the people are too poor to support more than one. In recent years the position of women has been improved in many ways. Their rights are protected by law, and they have much more freedom than formerly.

After the Young Turk revolution of 1908-09, the sultan ceased to be an absolute ruler. There was a ministry of the European type and a Parliament consisting of two houses—a Chamber of Deputies and a Senate. The constitution (first issued in 1876, but a dead letter until 1908) provides for personal liberty and security of property, abolition of torture, freedom of the press, and equality of all persons irrespective of religion, though Mohammedanism remains the state religion. Subjects of Western powers who were resident in Turkey were long protected by treaties (called "capitulations") which granted (among other rights) the privilege of trial before their own consuls; but Turkey declared the capitulations abolished in 1914. For purposes of local government Turkey is divided into "vilayets," each under a "vali" or governor appointed by the central administration.

THE OLD-FASHIONED STYLE IN VEILS

"The women are no longer forced to veil their faces when they go upon the streets, though many still cling to the thin half-veil—possibly because it gives an added charm to the bright dark eyes appearing above it!"

Rise and Fall of the Turkish Empire

It was under Orkhan (1326–1359), the son and successor of Othman, that the Turks wrested from the Byzantine Empire most of its Asiatic provinces and gained a foothold in Europe by the capture of Gallipoli. It was Orkhan also who founded the practice of levying the tribute of Christian boys and causing them to be reared as Mohammedans and trained under rigid military discipline for the famous military corps known as the Janizaries, or "new soldiers." These troops were maintained down to the 19th century, when they had become so powerful and lawless that it was found necessary to disband them.

Under Orkhan's successors the empire grew steadily. Adrianople was captured in 1361. Vast Christian armies were overthrown in the Balkans at Kossovo (1389) and Nicopolis (1396); and even the defeat and capture of the Sultan Bayezed I in 1402 by the mighty Timur (Tamerlane) the Mongol, at Angora in Asia Minor, administered only a temporary check. So, too, the long resistance of Scanderbeg, the hero of Albania, and of the "white knight," John Hunyady, prince of Transylvania, were only incidents in the irresistible advance of the Ottoman power. Finally Constantinople, an oasis in a desert of Turkish conquest, fell in 1453 before the assaults of Mohammed II, known as "the Conqueror," and the Byzantine Empire came to an end (*see* Constantinople).

Under Solyman the Magnificent (1520–1566), the greatest of the Ottoman sultans, Turkey attained the highest pinnacle of her power and glory. This "Grand Turk" crushed the forces of Hungary on the bloody field of Mohacs (1526) and led his army up to the gates of Vienna. Although Vienna was saved by its Austrian defenders, almost the whole of the kingdom of Hungary was converted into a Turkish province. From the Carpathian Mountains the Turkish power extended to the frontiers of Persia and around the Mediterranean to Morocco. The Black Sea was practically a Turkish lake, and Turkish corsairs ruled the Mediterranean.

In the next reign, however, the Turks met a serious defeat in the naval battle of Lepanto (1571), in the Gulf of Corinth, at the hands of Spain, Venice, and the pope. The decline of the Ottoman power soon began. There were weak and cruel rulers, and dissensions within the empire were added to disasters without. For a time there was a revival of power, and in 1683 there was another formidable attempt to take Vienna. Again the fate of central Europe seemed trembling in the balance; but after two terrible months King John Sobieski of Poland led an army of Polish knights to the relief of the city, and the great Turkish hosts were put to flight. Since that time Turkish power has steadily ebbed. By 1718 Hungary was lost. Russia, becoming a formidable rival as her power rose, gained control of the Crimea and the regions north of the Black Sea about 1783. The 19th century saw the gradual redemption of the Christian provinces of the Balkan peninsula from the tyranny of Turkish rule (*see* Balkan Peninsula).

"The Sick Man of Europe"

There was no force within the outworn Turkish Empire strong enough to hold together so many peoples of different race, language, and religion in the face of the rising power of Russia and Austria, and the whole structure was doomed to collapse. Turkey was "the Sick Man of Europe," as Czar Nicholas I of Russia called it, and the only question was as to who should fall heir to Turkey's European territory when the "Sick Man" should at last totter to his end. What should be done with these coveted lands—

especially Constantinople—that formed the gateway to the East; this was the great problem known as "the Eastern Question." When Russia took matters into her own hands in the Crimean War of 1853–56, fear of Russian aggrandizement led England and France to come to Turkey's aid and save the "Sick Man" from dissolution. (*See* Crimea.) Again, following the Russo-Turkish War of 1877–78, brought on by Turkey's "atrocities" in Bulgaria, Great Britain and Austria intervened and demanded that the peace terms of San Stefano should be revised by the Congress of Berlin to check the overgrowth of Russia's Balkan power.

A GROUP OF TURKISH CHILDREN

These two Ottoman lads in their fezes, sashes, and baggy trousers seem to be giving the cold shoulder to the little girls in the background. It isn't much fun being a girl in Mohammedan lands. There are great rejoicings over the birth of a boy, but the birth of a girl is considered almost a calamity.

But wars and insurrections continued wherever Turkey ruled. The people suffered under heavy taxation and the oppression of a corrupt and despotic government. Sultan Abdul-Hamid II (1876–1909), a despot of the worst sort, shut himself up more and more in his palace and left the government to greedy and unscrupulous officials. Modern improvements such as the telephone were forbidden on the ground that they might be used to aid conspiracies; all printed matter was submitted to a rigid censorship; and government spies were everywhere.

The "Young Turk" Revolution

Then came the "Young Turk" revolution of 1908–09, under the leadership of European Turks educated abroad and organized into a far-reaching secret society. Having gained the support of the army, they seized control of the government in July 1908; proclaimed the restoration of the constitution which Abdul-Hamid had granted in 1876 and then disregarded; and when in 1909 the Sultan tried to suppress the revolt by force, they deposed him and placed on the throne his younger brother Mohammed V, who ruled until his death in 1918, when he was succeeded by Mohammed VI.

Turkey's difficulties were not over, however. Austria incorporated Bosnia-Herzegovina and Bulgaria declared its complete independence. There were ill-advised attempts at enforced assimilation of the subject races; there were party quarrels and political assassinations. Then Italy fought a successful war to gain Tripoli (1912); and next year the Balkan allies (Greece, Serbia, Bulgaria, and Montenegro) fought a war which took from Turkey almost all of her remaining European possessions. The Young Turks' ill-advised alliance with Germany in the World War completed the ruin of the empire.

By the Treaty of Sèvres, never ratified by the Turkish government, Turkey was to be stripped of all territory in Europe, save for a small area about Constantinople. She was also to give up practically all her possessions in Asia outside Asia Minor, thus being reduced to an area of about 175,000 square miles and a population of about 8,000,000, against a former area of 613,724 square miles with 21,000,000 inhabitants.

Turkish resentment flamed high at these terms, and a revolutionary ("Nationalist") government was set up at Angora under the leadership of Mustapha Kemal Pasha. In 1922 Kemal routed the Greek armies in Asia Minor and retook Smyrna, which the Greeks had taken over under the terms of the treaty. The Nationalists then deposed the Sultan and forced the European powers to allow them to reoccupy Eastern Thrace up to the boundary of 1914.

The law of succession to the throne in the former Turkish Empire was peculiar in that it went, not to the sultan's oldest son, but to the oldest male member of the imperial family. All children born in the sultan's harem were legitimate and of equal lineage. The inmates of the harem were recruited mostly from the Circassian country of Georgia, in the Caucasus Mountains. The chief wives were styled *Kadin*, the others were known as *Odalik* ("odalisks").

As a Mohammedan state the law of Turkey is based on the Koran and the traditional sayings and actions of Mohammed and his immediate successors —which constitute the *Sunna* of orthodox Mohammedans. In the strict sense there is no Mohammedan priesthood; but the persons connected with the interpretation of the Mohammedan law and religion form a separate class—largely hereditary—called the *Ulema*. In Constantinople alone there are 379 mosques or Mohammedan temples.

Elementary education is nominally compulsory for both boys and girls, but the state schools are very poor. There are a large number of foreign schools mostly by French, English, and American missionaries. A government university founded at Constantinople in 1900 undertakes higher education. Robert College, founded in Constantinople by Americans in 1863, is the chief missionary college.

TURNER, JOSEPH MALLORD WILLIAM (1775–1851). "Billy is going to be an artist." In an obscure barber-shop, in a dingy London street, a delighted hair-dresser was showing his customers a crude childish drawing of a lion. But the words of the father were true, for his six-year-old "Billy" was J. M. W. Turner, the greatest landscape and sea-scape artist that England has produced.

TURNER
England's Greatest Landscape Painter

The customers of the humble little shop saw many other drawings of "Boy Turner," as the lad came to be called. They often hung about the shop for sale, for it was necessary to use every means to increase the father's scanty income, that the boy might be given an education to fit him as an artist. The lad did many odd jobs to help meet expenses. He colored prints for engravers, washed in backgrounds for architects, and made drawings in the evenings for a kind-hearted artist for "half a crown and his supper." In after years when pitied for this hard life, Turner said, "Well, and what could have been better practice?" From the dark skies and gray days of his boyhood may have come the great longing to picture "the light that never was on sea or land" which became the passion of his after-life. For always Turner painted light—light as he found it in the transparent air of noonday, in the afterglow of evening, in the passing cloud, or the reflecting water. These he painted and repainted until, at last, he was able to catch the very sunshine and put it on his canvas.

When yet in his 'teens he received a commission to make drawings for a magazine and in the next few years tramped over a good part of Wales and western England. Journeying on foot, his luggage at the end of a stick over his shoulder, his sketchbook under his arm, for days and weeks he lived with the earth and sea and sky, steeping his soul in their beauty. Later he tramped over northern England and Scotland, and frequently visited France and Italy, studying the historic and picturesque cathedrals and castles, rivers and harbors. His early sketches he made topographically exact, but in his later drawings he produced more the mental impression the scene had given him, and his picture became a poet's dream in color.

Turner was elected to membership in the British Royal Academy at the early age of 24, and from that time on his paintings were in great demand and brought good prices. He was not a success as professor of perspective in the Royal Academy, when appointed in 1808, but among the landscape artists of the time he was easily without a rival.

Turner's private life was eccentric. Except for his father, who lived with him for nearly 30 years, he had no intimate friends. Visitors were rarely admitted to the house where he lived, and no one was allowed to see him at work. He loved his paintings as a man loves his children. When induced to sell one, he would be dejected for days. He was especially fond of the one entitled 'Dido Building Carthage' and requested a friend to see that his body was wrapped in it for burial. The friend agreed but added, "I'll take pains to see that you are shortly dug up and unwrapped." This picture, with one of his other paintings, Turner willed to the National Gallery on the condition that they should always hang between two pictures of the famous French landscape painter, Claude, whose art Turner had always regarded as a challenge. Much evil has been said of his character, but those who knew him best found him gentle and considerate. Though sordid in his personal habits he was kind and generous to others.

When we hear Turner's name we always think of his famous oil paintings dealing with Venice or 'The Fighting Téméraire'. But as a water-color artist also Turner has never been excelled. His earliest success was won by his engraved plates of landscapes, many of them engraved by himself. This work was so much in advance of former landscape engraving that it might almost be reckoned a new development of art. On his death Turner's entire collection of paintings and drawings were willed to the nation and are in the National Gallery, London.

TURPENTINE. In the pine belt of the Southern states large numbers of trees have been killed by great gashes hacked in the trunk to obtain the resinous sap which is crude turpentine. For until a few years ago the production of turpentine meant the destruction of the trees. A cuplike cavity chopped into the base of the tree caught the sap that flowed from the chipped and scarred trunk above it. A tree so treated would live about four years. The method now used gives a greater yield and harms the trees but little. Through holes made in the bark the sap is collected in earthen pails or cups in much the same way as sugar maple sap is gathered.

The colorless, inflammable, hot-tasting and aromatic-smelling oil of turpentine is separated by distillation from the resin contained in the thick yellowish sap or crude turpentine. It dissolves sulphur, phosphorus, resins, fixed oils, and caoutchouc. It is used as a drying and thinning medium in paints and varnishes, and 70 per cent of the output is consumed by the paint and varnish trade. It is also used in medicine, both internally and externally, particularly as a counter-irritant in chronic inflammations.

The ARMORED CRUISERS *of the* REPTILE WORLD

Like medieval knights, turtles fight in full suits of armor, each trying to find some exposed spot where he may get a grip on his foe. These two fierce warriors are Spotted Turtles.

TURTLE. High rents and moving days never bother the turtle. In his portable, self-enlarging, storm-proof house, he takes possession of any sunny beach or meadow that suits his fancy, or with only the trouble of arriving at the water's edge his shelter becomes a house-boat or a submarine whenever it suits his pleasure.

There are more than 200 species of this shell-protected, toothless, but legged order of reptiles. They range in size from the little mud turtle that the schoolboy sometimes carries in his pocket to the great sea-roving leather-back turtle that measures from seven to eight feet in length and weighs as many hundred pounds. The curious house is formed by a bony growth, the upper part of which is covered with shields or plates of shell varying in shape and markings in the different species. The bony growth above the short broad body is joined to that below in such a way as to leave openings through which the head and legs can be drawn in under the shell except in the case of the water-dwelling turtles, who find their protection in their greater activity. In some species the tail is then wrapped around the body, covering the openings, and the house is thus protected like an armored tank from its enemies. But every hunter knows that he has only to turn the clumsy little tank upside down to convert it into a death trap, where his prey struggles in vain to right himself and when overcome with exertion can easily be carried away. The beak-like mouth has toothless jaws, which cut off mouthfuls of food, swallowed whole. Turtles have keen eyesight and seem to possess a very acute sense of hearing. When startled some give a loud snake-like hiss. They are not great travelers. Even the sea turtles return year after year to the same breeding beach. Marked terrapins and tortoises have been found season after season in the same location. They are long-lived creatures, some specimens having been known to reach an age of 250 years. The flesh of some varieties, especially the vegetable-eating turtle, is very good for food, while the eggs of most species are edible.

These eggs are buried in a sandy bank or beach where, using her tail as a spade and her hind feet as a shovel, the female turtle digs a hole in which she then deposits her eggs, with their tough leathery shells, in some cases 250 or more in number. These are covered with soil which she pads down so naturally that the hiding place is discovered only by prodding the sand in places frequented by turtles. A rotten log serves some land varieties quite as well as soil for a nest. Sometimes several months in sun and sand are required to hatch the eggs. The young turtles are left to take care of themselves and so are easy prey for land crabs and birds.

A HARD-SHELL AMERICAN

The Mud-Terrapins form an exclusively American family. The brown Pennsylvania Mud-Terrapin which roams over eastern North America from New York to the Gulf of Mexico is the best-known species.

The many species of turtle have quite different habits. Some live on land, some rarely leave the sea, and some divide the time between land and water. The land-living species are called "tortoises." They are generally a plain dull brownish color, feed largely on vegetable matter, have short clawed feet, and are slow in their movements. Tortoises are found in most temperate and tropical regions. Where winter prevails it is passed buried in earth or mud. The most conspicuous members of the tortoise group are the great land tortoises found in certain ocean islands. These sometimes grow to a weight of 500 pounds and have shells that measure more than four feet in length. They are now almost extinct. Other interesting tortoises are the box and the gopher tortoise, both in the United States. The latter live in pairs in self-dug holes, the former has plates hinged on the belly-side so that the body can be completely inclosed when its head and legs are drawn into the shell.

The turtles proper, that is the marine species, are the largest forms. Their flippers are paddle-shaped and adapted to swimming. The great leather-back is found in all tropical seas and has even been seen as

SHELL-BACKS OF SEA AND LAND

On the left, above, behold the Green Turtle, source of turtle soup. On the right is the huge Leather-Turtle, sole survivor of an ancient family whose jacket is tough and leathery instead of horny. The unamiable-looking beast below is a big Snapping Turtle. The Snapping Turtles are another simon-pure American family, members of which are found from Canada to Central America.

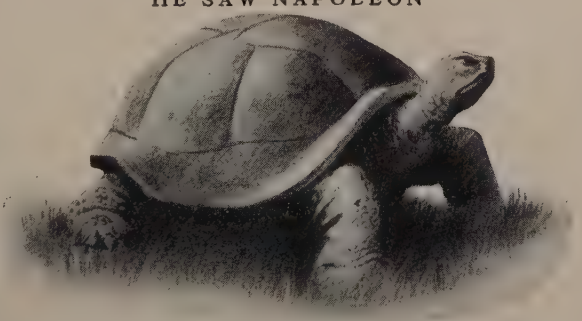
far north as the coast of Long Island or Great Britain. Its shield is a leather-like case something like the covering of the crocodile. It has great swimming power so that a dozen men can hardly drag a hooked specimen up on the beach. The flesh is strong and little used for food.

The green turtle, which sometimes weighs 1,000 pounds, furnishes the favorite turtle meat. It is found in various parts of the world including the West Indies, from which it is exported to Great Britain and the United States, where it is considered a delicacy. Sometimes the natives take this turtle by a very extraordinary method of fishery. They tie long strings to the tail of the echeneis, a fish of the mackerel family, and toss him overboard in a spot frequented by grazing turtles. The fish dashes at a turtle seeking shelter and attaches itself to the turtle's shell by a large sucking apparatus on the top of its head and neck. Thereupon the fishers gently coax the turtle up toward the surface by pulling on the string, or follow it into shallow water where it is easily traced by the string and captured.

The hawkbill turtle is the most valuable member of the group. The shields from its bony shell, when polished, are a beautiful mottled brown, and almost transparent. This is the highly prized tortoise shell of commerce. The terrapin, or mud turtle, lives in fresh water and is often on land. It both walks and swims well. It eats both animal and vegetable matter. The diamond-back terrapin is in such demand as a table delicacy that it is sometimes raised in inclosures for market. Snapping turtles sometimes grow to be three feet in length. They are fierce, and protect themselves by biting. The jaws are so strong that the turtle may be lifted by the object it bites.

In addition to these well-known members, the turtle order boasts many oddities. The matamata of Guiana and northern Brazil, a turtle which sometimes grows to be over a yard long, has fringes of skin along its neck. These float about like weeds, and small animals do not suspect its presence, as it lies quietly near the surface. When they are within reach it sucks them into its throat. The musk tortoise of North America, found in ponds all through the eastern United States, has a strong musky odor, which gives it the common name of "skunk turtle."

HE SAW NAPOLEON



When Napoleon's empire crumbled and the emperor was taken to St. Helena, this Giant Tortoise already lived on the island. He was still crawling about the island walks when Napoleon died; he was still crawling in his ancient way when Napoleon III rose and fell; he was still there when the World War began and ended; and, unless some accident has overtaken him, he is still there today.

Turtles are of the order *Chelonia*. They are generally divided into two suborders, *Athecae*, including the shell-less or leather-backs, and *Theocophora*, including all other kinds.

contained in the Easy Reference Fact-Index at the end of this work

TALES THE WOODMAN TOLD

WHY THE TORTOISE BITES SO HARD

ONE fine sunny afternoon Little Boy hurried off into the woods to climb the Big Oak that stands near the Minnow Pond. He wanted to play the game of make-believe, so he crawled out on a big limb hanging over the water and stretched out as quiet as a mouse.

The wind was blowing softly and the leaves whispered to him and told him he was far far away in the middle of Africa. It was time for all the beasts to come down out of the jungle to drink.

"And when the little antelope is drinking," said Little Boy to himself, "and when the big lion that's hiding behind that bush over there starts to jump on him, I'll shoot him dead as he goes rearing through the air, and save the antelope's life, and he'll give me a fine pair of horns to hang up on the wall with the lion's skin, and . . . ."

Just then Little Boy jumped so suddenly he nearly fell out of the tree, for he heard a noise right behind that bush, and out stepped something almost as big as a lion, only it was walking on its hind legs. For just about three seconds Little Boy was too frightened to breathe. Then he saw it was only the Woodman Who Was Wondrous Wise walking home to his supper.

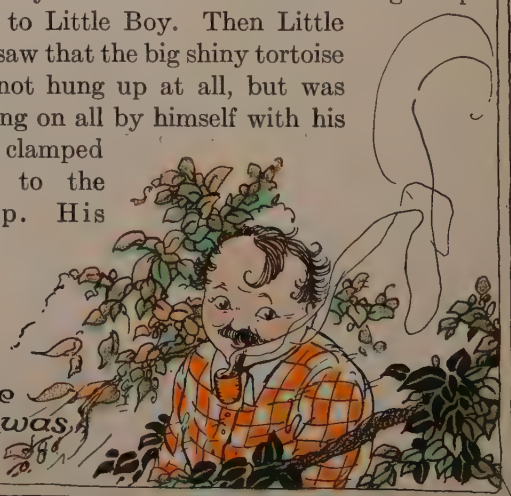
Little Boy came sliding down out of the Big Oak so fast he tore two holes in his stockings, but he was ashamed to say anything about the lion because he had been afraid.

The Woodman didn't say anything either, but kept his big ax hidden behind his back, and smiled his wondrous wise smile so that his great mustache almost curled up to his ears. Little Boy ran up and peeked around and saw one of the funniest things he had ever seen. Hanging at the end of the old leather strap on the ax handle was—what do you think?—a real live tortoise, a big humpbacked one with black and yellow marks on his shiny shell.

"Why do you hang him up like that?" asked Little Boy who hated to see good animals hurt.

What a Grip that Tortoise Had

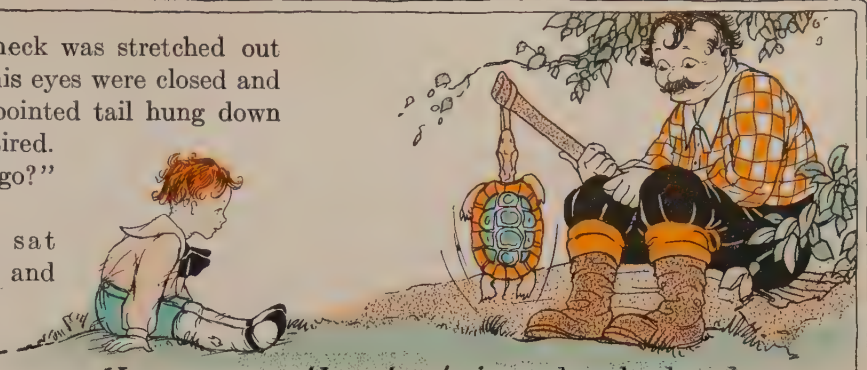
The Woodman smiled even more wondrously wisely and held the ax handle right up close to Little Boy. Then Little Boy saw that the big shiny tortoise was not hung up at all, but was holding on all by himself with his jaws clamped tight to the strap. His



queer wrinkled old neck was stretched out long and thin, and his eyes were closed and his paws and little pointed tail hung down as if he were awfully tired.

"Why doesn't he let go?" asked Little Boy.

The Woodman sat down on a dead tree and squinted through the Big Oak at the sky, for he could tell what time it was by the sun.



He swung the tortoise slowly back and forth as he told the story

"Little Boy," he said, "I think there's just time before supper to tell you the story of 'How Old Mother Nature Lost Patience with the Greatest Great-Grandfather of All the Tortoises.' "

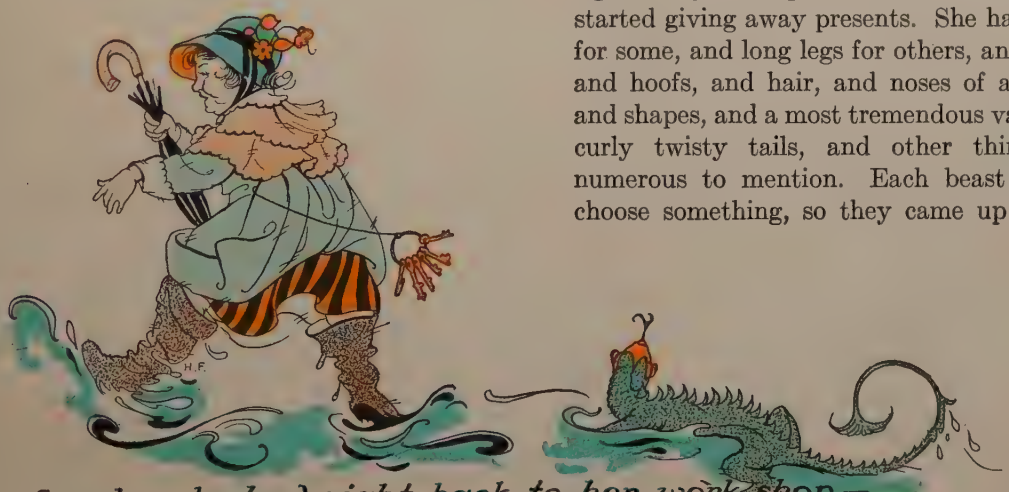
He held the ax handle out in front of him and swung the tortoise slowly back and forth as he told the story. Little Boy sat on the ground and watched it swing, and wondered if the tortoise was asleep and dreaming in some queer "tortoisy" way.

"A long, long time ago," said the Woodman, "there were no lions or elephants or horses or bears or dogs or cats or cows or giraffes or monkeys or chickens or ostriches or any such beasts in the whole wide wide world. There were nothing but creeping crawling things like lizards, and slimy swimming things that weren't just fish and weren't just frogs, but something, you might say, midway between the two.

"Well, Old Mother Nature was wading around one day—you see it was mostly water and mud at that time and those that traveled had to wade a good deal—well, she was wading around, as I said, and she suddenly decided she wanted to have more different kinds of animals, and not just creeping, crawling, slimy, swimming things. So she sloshed right back to her workshop and took down the big horn made out of a giant sea-shell that she kept over the kitchen stove. And she blew a most powerful toot on it.

Distributing the Animal Parts

"As soon as the toot had sounded, all the beasts came creeping and crawling and sliming and swimming up to her front door. And right away she opened her storehouse and started giving away presents. She had wings for some, and long legs for others, and claws, and hoofs, and hair, and noses of all kinds and shapes, and a most tremendous variety of curly twisty tails, and other things too numerous to mention. Each beast had to choose something, so they came up one by



So she sloshed right back to her work shop—

All the beasts came creeping and crawling and sliming and swimming

one and picked out what they fancied most or what they could find to fit, and then went flying, or running, or prancing, or snorting, or curling, or twisting away, depending on what they had chosen.

"Old Mother Nature was getting ready to lock up her storehouse, when she noticed one of the beasts leaning against the foot-scraper on her front doorstep—fast asleep. It was the Greatest Great-Grandfather of All the Tortoises who'd been left behind.

" 'What's the matter with you?' she said, poking him with her foot.

" 'I'm resting', said the Greatest Great-Grandfather of All the Tortoises, yawning.

" 'Well, wake up', said Old Mother Nature a bit gruffly, for the Greatest Great-Grandfather of All the Tortoises had very carelessly forgotten to cover up his mouth when he yawned. 'Wake up, and pick something out and be on your way. I've had a long hard morning's work'.

"Now you must understand, Little Boy, that the Greatest Great-Grandfather of All the Tortoises was quite a different animal from what you see hanging on this strap. He was long and slender, and, you might say, graceful. But he was terribly lazy.

" 'I don't really want anything, thanks', he said to Mother Nature, trying to be polite and make up for the yawn.

" 'Nonsense', said Mother Nature, 'you can't go on the way you are. It wouldn't look right. And besides you wouldn't last five minutes out there with those other animals. They'd eat you up. Come in here and pick out something quickly. There's a good pair of wings left'.

Too Lazy to Be a Bird!

" 'But flying must be such hard work', said the Greatest Great-Grandfather of All the Tortoises, stretching his legs and looking up at the sky where some of the new birds

were still flitting around.

" 'Well, here's a nice set of sharp teeth and claws, if you like to hunt', said Old Mother Nature, rummaging in her boxes.

" 'Oh, I'd rather rest than eat', said the Greatest Great-Grandfather of All the Tortoises.

" 'All right, then. Here are four fine long legs that you can use to run away with, when other beasts with sharp teeth try to eat you'.

" 'But, don't you see', said the Greatest Great-Grandfather of All the Tortoises, sighing out loud, 'I can't run and rest too? And I want to rest'.

" 'Well, then', said Old Mother Nature, 'take this pair of paws. They're for digging, and you can make yourself a nice safe hole and rest in it till you're tired of resting'.

"When Mother Nature mentioned digging, I want to tell you, Little Boy, that the Greatest Great-Grandfather of All the Tortoises positively shuddered and shook and turned pale. So she grabbed him by the back of the neck and dragged him without ceremony into her storehouse.

"But flying must be such hard work"

" 'I'll fix you', she said. And she took away all his nice graceful shape, and because he was too tired to eat she gave him a stomach that could get along for days and days without food. And because he was too tired to run she fitted on him the most awkward legs she could find. She gave him a big lumbering body and a foolish useless tail. And because she knew he'd be too lazy to look after his children, she said that tortoise eggs would always be laid in the soft earth and be hatched by the sun.

"What's the matter with you?" she said

How the Tortoise Got His House

"Then she stood back and looked at him, and saw how helpless he was. And she realized he would be so very very slow that he'd never be able to get back home before dark, so she took pity on him, and put his house right on his back, just the way you see it here. Then she saw that he'd never be able to escape from his enemies, so she told him he could draw his head and feet and foolish tail right inside his house and close the door. Then she turned him out, for she had other work to do.

"You see, the creeping, crawling, slimy, swimming things had, a good many of them, been changed into flying, running, prancing, snorting, curling, twisting things. But the whole outdoors was still pretty much covered with the old water and slime and mud, where they used to swim and crawl and

"I'll fix you", she said

Then she turned him out and went to bed

creep. Now Old Mother Nature saw that a lot of them were already having a hard time to run and prance and snort and curl and twist in all that mud. Even those with wings could hardly find a place to roost when they got tired of flying.

"So Old Mother Nature turned off the rain clouds and turned on the warm winds to dry things up a bit. Then she set the giant machinery in the middle of the Earth to working and heaved up a few mountain ranges and lowered the bottom of a few lakes and oceans so the mud and water would drain down nicely. Then she called it a good day's work and went to bed."

Little Boy was still watching the tortoise swinging from the ax handle when the Woodman got up from the dead tree.

"But you haven't told me why a tortoise doesn't let go," said Little Boy.

"Well, well, did I forget that?" said the Woodman, smiling his wondrous wise smile.

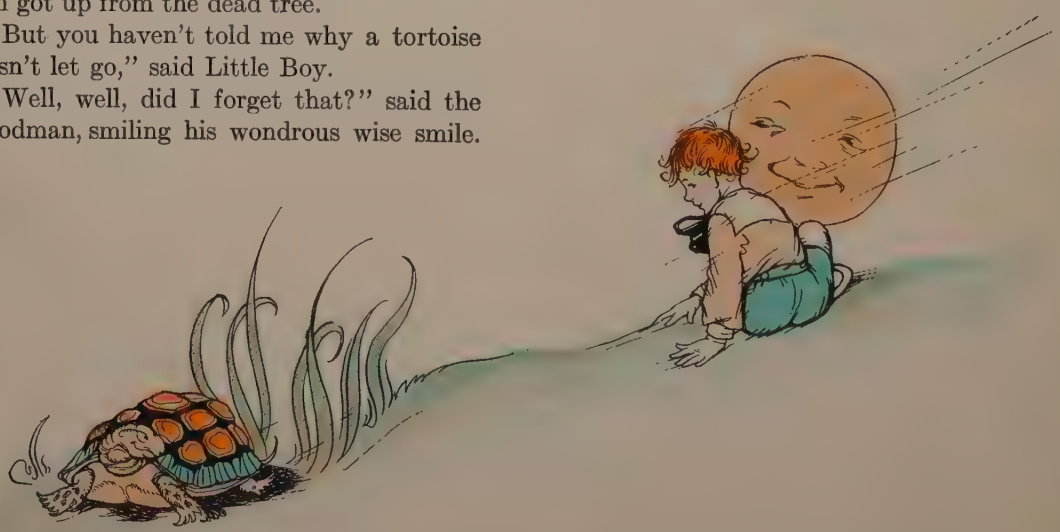
"Well, you see, the Greatest Great-Grandfather of All the Tortoises came back the next day complaining. He said he had felt a little hungry after all the work he'd done the day before, but that he was so slow now that he couldn't catch a single living thing.

"'Well', said Old Mother Nature, 'it's too late to change things now. You'll have to catch things while they're asleep or become a vegetarian. But I'll do this much for you. I'll fix your jaws so you won't ever let go of what you catch.'"

"Doesn't a tortoise ever let go?" asked Little Boy.

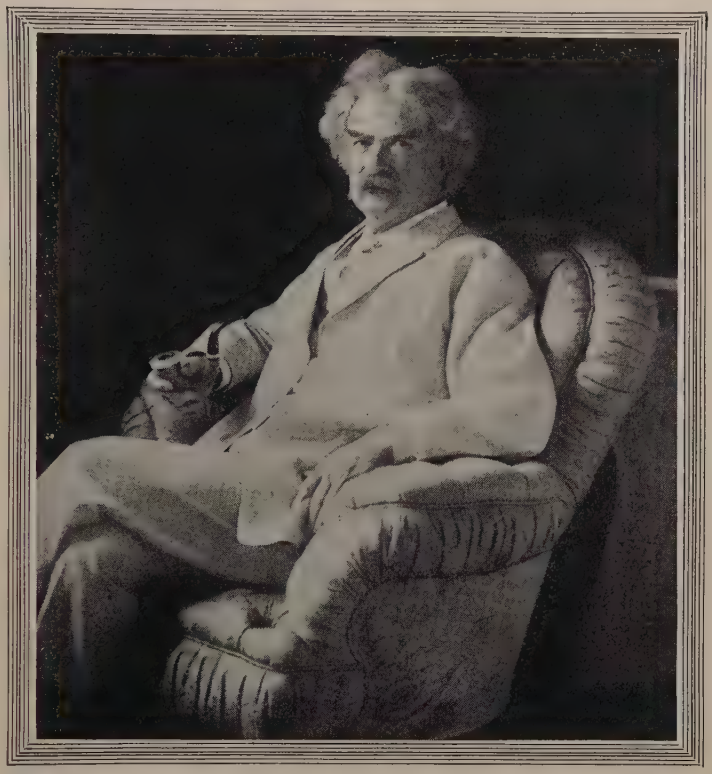
"Well, hardly ever," said the Woodman—and just then the old tortoise slipped off the end of the strap and hit the ground with a thud. But it didn't seem to hurt him a bit. He blinked his eyes as if he had just had a nice long rest, and waddled off into the bushes. The Woodman Who Was Wondrous Wise swung his ax over his shoulder, started off through the woods to supper, and Little Boy knew it was time to hurry home too. As he ran, he heard the big deep voice of the Woodman singing a queer song. It ran something like this:

The tortoise can't go out to play,
Or sell his house or rent it;
For when he moves, his house moves too,
And nothing can prevent it.



He blinked his eyes and waddled off into the bushes

"TWAIN, MARK" (SAMUEL LANGHORNE CLEMENS) (1835–1910). Away back in the palmy days of steamboating on the Mississippi River, the most exciting event in the frontier town of Hannibal, Mo., was the arrival of a steamer. When the whistle blew the small boys raced to the village wharf to see the boat warp in, while the lookout took soundings of the shallowing water and the pilot shouted his orders, calling out "mark twain" to show the depth of the water. Capt. Isaiah Sellers used this as a pen name, and on his death it was taken by Clemens.



"MARK TWAIN"

This celebrated American humorist and novelist was born in the small inland town of Florida, Mo., but his parents soon moved to the lively river-port of Hannibal. There he grew up, got the rudiments of an education in an ungraded school, learned the printer's trade, and later became a river pilot. Really he was still going to school, for the river highway, which then swarmed with travel and trade, was the great university of life in the West. He saw so many odd and interesting things and people on his voyages that when he began to write within a few years he at once made his pen name famous, though his real name was for long unknown to many of his admirers.

When the Civil War interrupted steamboating on the Mississippi, Samuel Clemens accompanied his brother, who was appointed secretary of Nevada Territory. He made his living in mining camps of Nevada and in California as a reporter and editor. The first story of his that attracted attention in the East was 'The Jumping Frog of Calaveras.' In 1866 he went on a trip to the Sandwich Islands, and soon after started his long and successful career as a lecturer and popular entertainer. As the result of a trip to the Mediterranean, Egypt, and Palestine, he wrote 'Innocents Abroad' (1869), a book which won for him a world-wide reputation.

We are glad and proud today that Mark Twain's humor was recognized at once as being characteristically American, for it is clean, good-natured, shrewd, and independent in opinion. It is exaggerated to the point of burlesque, but it is never low or vulgar; and there is no sting in his wit, for the joke is always on some sham or hypocrisy, and usually has a shrewd lesson in it. He makes pretense and snobbishness look so foolish and funny that he sets the world to laughing at them, and then to thinking seriously.

As a lecturer, story teller, and humorous writer Mark Twain had no rival. But he was not content with the rôle of jester and entertainer. He studied history and biography and heroic legend, and won new laurels with his beautiful idyll, 'The Prince and the Pauper'; in his satire on the romances of chivalry 'A Connecticut Yankee at King Arthur's Court', and his historical novel dealing with Joan of Arc. Out of the heart of his own boyhood, ripe in knowledge and philosophy, he drew his boys' classics 'Tom Sawyer' and its sequel 'Huckleberry Finn'. In doing this he incidentally made the Mississippi a literary river, like the Hudson, by preserving a dramatic phase of its life that has now almost completely passed away.

For many years Mark Twain made his home in Hartford, Conn. In 1895 the failure of a New York publishing house in which he had invested his fortune rendered him penniless, with a huge burden of debts. These he courageously assumed, paying them off by a lecturing tour in 1895–96. His reputation, when he died, both as a man and as a writer, was as secure in Europe as in America.

His chief works are: 'The Jumping Frog' (1867); 'Innocents Abroad' (1869); 'Roughing It' (1873); 'The Gilded Age'—with Charles Dudley Warner (1873), dramatized as 'Colonel Sellars'; 'Adventures of Tom Sawyer' (1876); 'A Tramp Abroad' (1880); 'The Prince and the Pauper' (1882); 'Life on the Mississippi' (1883); 'Huckleberry Finn' (1885); 'A Connecticut Yankee at King Arthur's Court' (1889); 'Adam's Diary' (1894); 'Pudd'nhead Wilson' (1894); 'Personal Recollections of Joan of Arc' (1896); 'Following the Equator' (1897); 'Captain Stormfield's Visit to Heaven' (1909), etc.

contained in the Easy Reference Fact-Index at the end of this work

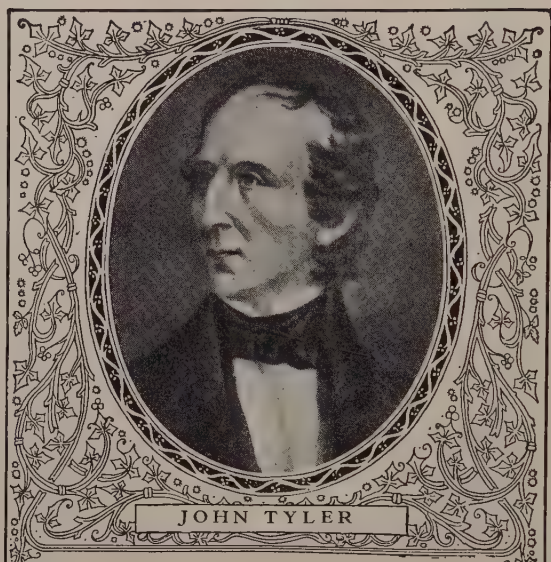
TWILIGHT. If there were no twilight we should have to turn on the lights right after sunset; and if the earth had no atmosphere there would be no twilight. That period of fading illumination which we call "twilight" is due to the fact that the atmosphere is filled with vapors and particles of dust which reflect the light of the sun back to the earth after the sun has sunk below the horizon. By observing the length of the twilight it is possible to get some idea of the height of the atmosphere, and scientists have calculated that the zone in which the atmosphere is dense enough to reflect the rays of the sun is from 50 to 60 miles high. The length of the twilight is also affected by the latitude of the observer; toward the Equator twilight rarely lasts more than 30 minutes, but in polar regions, at certain seasons of the year, it may fill the entire interval between sunset and sunrise. Before sunrise we also have a period of twilight like that in the evening, but it is more usual to speak of the morning twilight as "dawn."

"HONEST JOHN'S" *Stormy* ADMINISTRATION

TYLER, JOHN (1790–1862). "Honest John Tyler" regarded himself as one of the "Virginia presidents" and predicted that he would be the last one of the line. He was indeed the last president, up to the present time, who was born and bred in the "Old Dominion," but he hardly belongs in the same classification with Washington, Jefferson, Madison, and Monroe.

In the first place, Tyler was not elected president at all, but came to that office from the vice-presidency at the death of William Henry Harrison, in 1841. He was the first vice-president to so obtain the place of chief executive. In the second place, he did not belong to the age of Washington, which produced the fathers of the Revolution and the Constitution, but belonged rather to the Jacksonian period of partisan politics.

But though Tyler was not one of the Revolutionary statesmen who had founded the government and whose succession to the presidency had "ended in a sort of a chill with John Quincy Adams," Tyler had education and experience which might have rendered him a suitable candidate for the presidency. He was the son of Judge John Tyler, who had served as governor of Virginia, from 1808 to 1811, and he had inherited traditions of public service. He had been educated at William and Mary college, from which he was graduated in 1807. Two years later he was admitted to the bar, at the age of 19; and when he was 21 his public career began with his election to the Virginia House of Delegates. Before he was called to the presidency by the death of his chief, he had served in both houses of the Virginia legislature, in both houses of Congress, as governor of his state, and as vice-president for one month.



JOHN TYLER

TYLER'S ADMINISTRATION
(1841–1845)

Bill to reëstablish a National Bank vetoed (1841).

Tyler's Quarrel with the Whigs; President read out of the Party (1841).

Webster-Ashburton Treaty concluded with Great Britain (1841).

Dorr's Rebellion in Rhode Island (1842).
First Telegraph Line completed (1844).

James K. Polk, Democrat, elected President (1844).

Texas and Florida admitted (1845).

With such a long term in office back of him, it would seem that his political opinions should be familiar to the people of America. Yet the uncertainty of his stand on important questions of the times made his administration one of the most exciting ones which the country up to that time had experienced. The trouble was that Tyler believed stubbornly in a strict construction of the Constitution. For this reason he had, while in Congress, opposed internal improvements, a national bank, and the "Tariff of Abominations" of 1828, and had allied himself with the Democratic party, which was the strict construction party. During Jackson's administration, however, Tyler had opposed the high-handed policy of that leader of the Democratic party. Quite a number of Southern Democrats had joined Tyler in this opposition, and it was to capture their votes that the Whigs, in 1840, nominated Tyler as vice-president. They reasoned that, as vice-president, he would have no influence on the administration; and, as the Whigs adopted no party platform in 1840, Tyler did not find it necessary to make public his opinions on the questions of the day.

But the unexpected happened, and on April 4, 1841, Tyler was called upon to become the 10th president of the United States. It was with misgivings that the Whigs, recalling his strict construction views, saw him elevated to the place of chief executive; and their misgivings were fully justified.

Tyler vetoed the bill to reëstablish the Bank of the United States shortly after he took office. The Whigs tried to draw up a new bill which would meet his approval; but although he seemed to accept it at first, when it was sent to him he promptly vetoed it also. This so angered the Whig leaders that they then issued a statement that they were in no way responsible for the President's acts.

The cabinet appointed by President Harrison promptly resigned, with the exception of Daniel Webster, secretary of state, who was engaged in important negotiations and continued in office for a time. The boundary on the northeast had never been satisfactorily defined and there had been constant friction between Canada and the United States; this was ended in 1842 by the Webster-Ashburton Treaty drawn up by Webster and Lord Ashburton, the British ambassador.

Tyler and the Whigs also quarreled over the question of the tariff and internal improvements. An alliance between the Democrats and a "corporal's guard" of Whigs, who followed Tyler out of the party, kept Congress from passing bills over the president's veto. A tariff bill, however, was finally framed which met the president's approval.

Tyler's quarrel with the Whig party angered the politicians, but his disposition not to deal in the open aroused the whole country. After consultation with only a few of his associates, he negotiated a treaty with Texas for the annexation of that commonwealth to the United States (*see* Texas). Without warning he sent the treaty to the Senate for ratification. It was promptly defeated, although many of the senators, especially those from the South, desired to see Texas come into the Union. Finally, on the last day of Tyler's administration, Texas was admitted by a joint resolution of Congress.

So Ended John Tyler's Career

His quarrel with the Whigs and his policy while in office not only destroyed all chance for Tyler's reëlection to the presidency but likewise ended his political career. When his term of office ended, in 1845, there was nothing for him to do but to retire to his estate, Sherwood Forest, in Virginia on the James River. There he lived until the slavery crisis of 1860 again called him into action. In January 1861, he recommended that a convention of border states be held to find some means of averting the threatening conflict between the North and South. In accordance with this suggestion a peace convention met in Washington, on Feb. 4, 1861, and the ex-President was chosen to preside over the meeting. When its suggestions were rejected by Congress, Tyler hurried to Richmond, where in the state convention he advocated immediate secession. When Virginia joined the Confederacy, Tyler was elected a member of the provisional congress and later was chosen to the permanent congress of the Confederacy, but died before he could take his seat in that body.

If we accept the testimony of two of Tyler's successors in the presidential office, the Confederacy did not suffer a great loss in his death. President Wilson said of Tyler that "Nature and habit forbade him a frank, straightforward, unhesitating course," and that "he had neither the initiative nor audacity enough for leadership." President Roosevelt was even more severe in his judgment, for he declared that "Tyler has been called a mediocre man, but this is unwarranted flattery. He was a politician of monumental littleness."

Tyler, Wat. As the principal leader of the first great revolt of the common people in England, Wat (or Walter) Tyler flashed into the light of history only to come to a violent end. This revolt, known as the "Peasants' Revolt" (1381) or as "Wat Tyler's Rebellion," was one of the first great struggles of labor against capital. It anticipated the fierce social struggles in Germany at the time of the Reformation, and the still greater upheaval of the French Revolution in the 18th century.

Those were troubled times. The workers both in country and city, the peasants and the artisans all over England, were angry and discontented. The peasants wanted to be free from serfdom, to pay a reasonable money rent for their farms, and both town and country laborers wished not to be compelled by law to work at wages that were no longer sufficient. Also the war in France was going badly, and many people felt that the counselors of the young king Richard II were responsible for its failure and the heavy taxes that oppressed them. A "mad priest," John Ball, went about preaching against the social and economic injustices and demanded that the distinction between lord and serf should be wiped out. This idea was expressed in the popular rhyme:

> When Adam delved and Eve span,
> Who was then the gentleman?

So when the government passed a law that everybody, rich and poor, should pay a poll tax of exactly the same amount, revolt broke out, the greatest risings being in the southeast near London. Under the leadership of Wat Tyler, whose energy and wit had forced him to the front, the men of Kent marched toward London, destroying tax rolls and title deeds, and burning houses of royal officials, lawyers, and unpopular landlords. When they reached London and were joined by crowds coming from other directions, they showed remarkable moderation and self-control. Only a few men who were held chiefly responsible for the bad government were sought out and killed. The chief desire of the rebels was to speak with the young King Richard II, a boy of 14.

When Richard came to them, Wat Tyler presented their demands. These were moderate. They asked

that serfdom be done away with; that the rent for their lands be fixed at a reasonable rate; and that no one should work for another except of his own free will and for wages mutually agreed upon. Furthermore they demanded that Richard give up his evil advisers and be directed by his people.

Richard granted everything, and the great mass of the rebels began turning homeward. Tyler himself remained till the next day, for another interview with the king. At this interview he was treacherously trapped and slain. With their forces scattered and their leader slain, the rebels were easily crushed. Parliament, representing only the upper classes, met and revoked all the king's promises. Many lords not only reasserted their old rights but tightened the bonds.

Thus the revolt of 1381 led to no startling changes. Yet the growing interest in sheep farming and the custom of leasehold farming gradually were bringing about many of the changes demanded, and from this date serfdom practically disappeared in England.

TYNDALL, JOHN (1820–1893). Huxley and Tyndall, the two men who first showed the English-speaking world that science is as wonderful and entrancing as a fairy tale, were so closely associated in the popular mind that while they were living their personalities were often amusingly confused. They were both great popular teachers of science; but while Huxley, trained as a physician, gave his energies to biology, Tyndall, largely self-trained and in early life a railway engineer, devoted himself to physics. He was greatly influenced by early association with Faraday, whose colleague he was as professor of natural philosophy at the British Royal Institution. Tyndall made original investigations on many subjects, including the motion of glaciers, the transparency and capacity of vapors and gases for radiant heat, and the opacity of the air for sound. His disinterestedness was shown when he concluded his lecture tour in America (1872–73); he refused to accept any of the money earned, but placed it all in the hands of trustees for the benefit of American science.

Among his best known writings are: 'Heat Considered as a Mode of Motion' (1863); 'Fragments of Science for Unscientific People' (1871); 'The Forms of Water in Clouds and Rivers, Ice and Glaciers' (1872); 'Six Lectures on Light Delivered in America' (1873).

TYPE. The raised letters used in printing are known as type. There are many different styles of type faces —such as roman, italic, gothic, script, etc.—and the sizes range from the tiny types of the "thumb" editions of the Bible to the enormous letters of the billboards. They are usually made of type metal, although some of the larger sizes are carved from hard fine-grained woods.

In printing establishments, no matter how the letters may differ as to style and size, the type body must be alike in one particular—height—so that when thousands of them are wedged tightly together to fill a page form, the printing surface will be perfectly even. As cast by American and English type foundries, the height is .92 of an inch.

The letter itself, known as the face, is on the upper end of the type body. The type body has a shallow groove—sometimes several—on one surface so that the printer can tell by a touch or a glance which is the front. In American, English, and German types, the front of the body is "nicked," and in French types the back. The bottom end of the type body also is hollowed out so that the type has two "feet" on which to stand.

Type metal is an alloy of lead, antimony, and tin, and sometimes copper. This alloy has many remarkable peculiarities. Unlike most other metals it expands when cooling, thus filling the mold completely and giving sharp clear castings. Although types are exposed constantly to air, water, oils, inks, and alkaline solutions, they are little affected by any of them.

The first printers cast their types by pouring the hot melted metal into hand molds. Soon, however, type foundries were established, and the making of types became a business separate from the printing trade. Type-casting machines were introduced about 1845, and in 1890 the Barth automatic type-casting machine came into use, capable of casting 150 completed types a minute. The use of hand-set type has been greatly reduced by the introduction of the linotype, which casts solid lines of reading matter, and the monotype, which casts separate types as set for printing. Both are operated by keyboards. Many large printing establishments now have type-casting machines on which type for hand setting is cast in the office. A font of matrices of the desired type is purchased or rented from the type-foundry and an indefinite number of replicas made from it.

A "font" of type includes all the characters in sufficient numbers for ordinary composition. In almost any combination of words the letter *e* is used most frequently, so a font of type contains more *e*'s than any other letter, and very few *z*'s, which are needed infrequently. A printer's type "case" usually consists of an upper and lower case. In the upper case the capital letters, small capitals, and certain special characters are kept; in the lower case are the small letters, figures, punctuation marks, and spaces. Capital letters are often called "upper case" letters and small letters "lower case."

Formerly sizes of type were indicated by special names, but now the more accurate "point system" is used in designating type faces, a point being $\frac{1}{72}$ of an inch. The following table gives both the old name and the "point system" designations for a number of the most commonly used sizes:

Great primer	18 pt.	Minion	7 pt.
English	14 pt.	Nonpareil	6 pt.
Pica	12 pt.	Agate	5½ pt.
Long primer	10 pt.	Pearl	5 pt.
Bourgeois	9 pt.	Diamond	4½ pt.
Brevier	8 pt.	Brilliant	4 pt.

In the "scareheads" of newspapers, which run across the entire page, type as large as 280 points is sometimes used. The type used in the body of this work is 9 point; the table above is in 7 point.

TYPEWRITERS. Only a curiosity in 1880, the typewriter has today an indispensable part in the conduct of the world's business. Tabulating and adding mechanisms, added to ordinary typewriters, have made it possible to do all commercial bookkeeping on the same machine used for correspondence. Machines have also been devised which can be used for writing on cards, on the pages of a bound book, etc. Electrically operated machines typewrite automatically from a stencil pattern approximately 20 sheets of average length an hour. Small typewriters, weighing only a few pounds, are carried by army officers, explorers, and war correspondents into the far corners of the world or when campaigning.

Many years of effort have been necessary to develop these wonderful machines. The first experiments resulted in heavy, clumsy affairs. Some of these early machines were devised primarily for the use of the blind. In 1874 the first really practical typewriter was placed on the market. It was made by the gun manufacturers, E. Remington & Son, at Ilion, N.Y., from a model designed by C. L. Sholes, an editor living in Milwaukee. While this machine was heavy and awkward, the right idea was there, and from it the great majority of the typewriters of today have been directly developed.

The two prevailing models in typewriters are the type-bar and the shuttle machines. This first Remington, a type-bar machine, carried type letters on the end of steel bars. These bars, about 38 in number, were pivoted about a horizontal ring, making practically a complete circle of type-bars, and when the keys were depressed the type arms rose sharply to a common center on a rubber cylinder carrying the letter paper. In front of the cylinder and between it and the head of the hammer-like type-bar an inked ribbon was passed, thus giving the inked impression of the letter on the paper. The shuttle machine is represented by the Hammond typewriter. All the letters and signs used in this machine are cast on a curved plate of vulcanite called the "shuttle." When the key is depressed the corresponding character on the shuttle is brought into position, and the paper is forced against it to receive the impression. The shuttles for these machines are interchangeable, making it possible to produce many different alphabets and many different styles of type on the same machine. Another machine, the Blickensderfer, has all the type on a wheel which strikes the paper on the rubber cylinder, rotating to bring the desired characters into position.

By the closing years of the 19th century, when the typewriter came into universal use, there were nearly 100 models on the market. The greater number of these followed the conventional type-bar model modified so that, instead of the old horizontal ring, the frame holding the type-bars is an arc of a circle with the type-bars striking the common center on the front of the rubber cylinder instead of the lower side. By this arrangement the work is visible at all times. The arrangement of the keys which the operator strikes is practically the same on all makes of typewriters. This common arrangement of the letters of the alphabet is known as the "universal" keyboard. On this keyboard the letters are arranged to bring those most frequently used directly under the operator's hand. Each type-bar carries two or more characters, as small letters and capitals, and shift keys govern their use. By putting in several sheets of paper with carbon paper between them several copies can be made at the same time. An average operator can write 60 words a minute—about three times as fast as an average penman. Experts can keep up a rate of 100 words a minute or more.

The typewriter has had an important part in the entrance into the business world of the army of women workers. It was found that women could manipulate the typewriter as well if not better than men, and more than half the women engaged in clerical work are stenographers and typists. In the modern use of the typewriter the touch system by which the operator is taught to locate the position of the keys without looking at the keyboard is chiefly taught.

The United States leads the world in the manufacture of typewriters. More than half the factories of the country are in New York.

TYROL (*tĭr'ōl*). Straddling the frontier between Austria and Italy lies the beautiful Tyrol, "the land in the mountains." Visitors usually enter this world-famous region by way of Zurich in Switzerland, and diving from tunnel to tunnel—the longest 6½ miles—under glaciers and tumbled snowy crags, arrive at Innsbruck, the chief city of this second and more smiling Switzerland. A clear air off the snow fields filters down through the pine woods, and the train winds through a panorama of snow mountains, fertile valleys, flowery pastures, rushing torrents, musical little streams, rocky peaks and quaint villages. Here and there the traveler catches a glimpse of peasant women in their broad velvet hats, embroidered bodices and aprons with snowy white linen sleeves, or a man in his feast-day costume of green velvet waistcoat, black velvet knee breeches, and thick brown woolen stockings, with a jaunty Tyrolese hat with feathered band perched on his head.

From the South the Italian Tyrol is reached by way of Verona, the railway following the very route along the Adige River which the ancient Romans used, and which is still marked by their milestones. This route crosses the Brenner Pass, which is the lowest in the Alps, and leads all the way from Italy to Germany without climbing higher than 4,500 feet.

The Tyrol is completely hedged in by mountains, and its whole area of about 10,305 square miles is ridged with heights and valleys. On the Austrian side rise the Hohe Tauern with the Gross Glockner peak about 12,500 feet high; on the German side are the hills known as the Bavarian Alps; on the Swiss side, the Ortler group soaring almost 12 800 feet; and included in the Italian Tyrol to the southeast rise the Dolomites. The latter are favorites with mountain

THE HIGHLAND FIELDS AND LOFTY PEAKS OF TYROL

This is harvest time on one of the fields for which the lofty Tyrolese peaks grudgingly make room. Peasants are busy binding the grain, cut with the ancient sickle, for these tiny fields do not justify the introduction of modern machinery. In the middle distance is one of the roadside shrines so common in this country, with a crucifix under the penthouse; on the upper broken ground is a chapel.

climbers, because of their sharp beautifully shaped peaks, and the peculiar crystalline composition of the rocks which make them shimmer in the sun with beautiful rainbow colors.

The chief industry of the Tyrol of late years has been catering to tourists, though grazing and agriculture, particularly the raising of wine and fruit, are carried on. Of the mining industry that made Tyrol one of the richest of the Austrian crown lands in the 15th and 16th centuries, hardly a trace remains except the salt works at Hall near Innsbruck. Spinning and weaving are still home industries. The natural skill of the Tyrolese in wood-carving has developed in St. Ulrich until this region has become a veritable toyland, whose dolls, hobby horses, and Noah's ark animals go all over the world.

In the Middle Ages the counts of Tyrol established their sway over all this region, the last count leaving a daughter who bequeathed her rights to her cousins the dukes of Austria in 1363. By the treaty of Pressburg it was ceded to Bavaria in 1805, the occasion of Andreas Hofer's uprising, but was restored to Austria by the treaty of Paris in 1814. During the European war the Tyrol was invaded by the Italians, and in the peace settlement all of the region south of Brenner Pass was given to Italy.

UKRAINE (*u'krān*). In the southwestern part of the old Russian Empire, on both sides of the lower course of the majestic Dnieper River and bordering on the Black Sea, lies the region called Little Russia or "the Ukraine." It is a rich country, for the fertile soil of the famous "black belt" produces immense crops of wheat and other grains, as well as quantities of sugar beets, and its coal fields of the Donetz basin are among the richest in Europe. There are also iron ore, petroleum, salt, and other minerals. The Dniester River separates it from Bessarabia, now a part of Rumania. Kief, the capital (on the Dnieper), Odessa, the chief seaport (on the Black Sea), and Kharkof, in the center of the rich agricultural district, are the largest cities.

The name Ukraine, which means "border-land" or "frontier," was given to this land when it was the bulwark of the Slavic countries against the Tatars and the Turks. Here in the 16th century gathered bands of adventurers, freebooters, and other restless and lawless men from Lithuania, Poland, Russia, and even Turkey, who became known as Cossacks (*see* Cossacks). There are still Cossacks here today, who maintain their reputation as skilful horsemen and ruthless warriors; but most of the Ukrainians are quiet peace-loving peasants. In the 18th century most of the Ukraine was annexed to Russia, but the western part went to Austria, where the Ukrainians became known as Ruthenians.

In the 19th century a strongly nationalistic literary movement was carried on in the Ukraine. When the Imperial Russian government was overthrown in 1917, advantage was taken of the situation to set up the republic of Ukraine. This was opposed by the Soviet Russian government; but in the peace of Brest-Litovsk, imposed upon Russia by victorious Germany and Austria early in 1918 Ukrainia was recognized as a separate republic. In the troubled times which followed the German downfall, the Ukrainians fought the Poles as well as Soviet Russia, and their soil was reddened with civil strife between the forces of reaction and the peasants, whose chief concern was to keep the lands which the revolution had brought them. The area of the Ukraine politically is about 197,000 square miles, and its population 30,000,000.

UKULELE (*u̯-kĕ-lā'lĕ*). One of the most popular musical instruments among the boys and girls of America is the ukulele, a simple strumming instrument introduced by Hawaiian singers, who used it as an accompaniment to their weird songs. The ukulele is a small guitar-shaped instrument. It was designed by a white man who used as his model the "taro-patch fiddle," a Portuguese instrument adopted by the Hawaiians and played by them for more than a century. It differs from the taro-patch violin in that it is much smaller and has only half as many strings. The Hawaiians eagerly took up the ukulele and now no festal gathering of these music-loving people is complete without the music of ukuleles.

UNIFORMS. Some marks of identification have always been necessary among fighting forces to distinguish friend from foe. In ancient times national dress and weapons were usually sufficient to serve this purpose. In the Middle Ages temporary badges, such as the white and red roses of the Wars of the Roses in England, were occasionally adopted. King Henry VIII of England introduced a complete uniform, clothing the royal archers in white gabardines with caps of a standard design. Uniforms for large bodies of troops, however, did not come into use until the rise of truly national armies, such as the armies of the Commonwealth in England. By the beginning of the 17th century there were distinctive uniforms for each of the national armies of Europe.

The styles of military uniforms were long merely civilian styles modified to give greater splendor and display. This tendency reached its height during the Napoleonic era, when the British "redcoats" vied in splendor with the French troops in their gorgeous green and white. With the improvement of firearms toward the close of the 19th century, conspicuous uniforms became dangerous, and service uniforms of the most inconspicuous colors possible came into use. The British army led the way by adopting a khaki-colored uniform for its Indian troops about 1880.

After the Boer War this change became general throughout the world, and each army adopted the color which was supposed to be best suited for the particular region in which its campaign operations probably would be conducted.

The United States adopted olive-drab in 1902. Germany adopted *feldgrau*, ("field gray," a dark olive-gray mixture) in 1908, and the French came last with horizon blue, which was adopted only after the first months of the World War had shown the disadvantages of the brilliant red trousers and blue coat of the old infantry uniform. Showy uniforms are now retained for parade and sometimes for garrison duty, and are called "dress" uniforms, as distinguished from "field" or "service" uniforms.

MARKS OF RANK AND SERVICE IN THE ARMY

You can tell an American Army officer's rank by the shoulder tab ornaments on his coat, or the sleeve insignia of his overcoat. The different insignia are shown to the left. The stars and other badges are silver, except the Major's oak leaf and the Second Lieutenant's bar, which are gold. The overcoat stripes are of black braid, except that of the Second Lieutenant, which is brown. If coatless, officers wear their grade insignia on their shirt collars. Chevrons, worn on the upper sleeves of shirt, coat, and overcoat, show the grade of non-commissioned officers and first-class privates. The branch of service is shown by the insignia to the right. By officers, these are worn "cut out," as shown, on the coat and shirt collars; for enlisted men they are embossed upon a round button worn on the coat collar. Chaplains wear silver crosses. The initials "U. S.," "U.S.R.," and state initials indicate Regular Army, Reserve, and National Guard troops, respectively. Aviators wear their "wing" insignia on the breast of the coat. Marine Corps trimmings resemble those of the army, save that the Corps badge is worn in place of the "branch of service" insignia.

For any subject not found in its aphabetical place see information

MARKS OF RANK AND SERVICE IN THE NAVY

The American naval officer's rank is designated by gold stripes on his coat sleeve, or by the insignia on the shoulder tabs of his overcoat. Beginning with the Ensign's half-inch sleeve stripe, each additional "half" stripe means one grade higher. Thus, a one-inch or "full" stripe indicates a Lieutenant, junior grade. There is no half stripe between Commander and Captain, however. The two-inch stripe is worn only by Admirals, and here full or "double" stripes mark each advance in rank. The star designates a line officer. Above Captain, grade is shown by stars and anchors instead of stripes on the shoulder tabs. Chief Warrant and Warrant Officers wear a narrow stripe, and rank below commissioned officers but above Chief Petty Officer. The Chief Petty Officer wears his rate badge of red and silver on his upper sleeve, as do all Petty Officers. The insignia shown at the upper right hand are part of the "rate" badges, and indicate the branch of service. Those branches marked with a star also have the Warrant grades.

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During the Revolution, American uniforms followed the current English pattern, with three-cornered hat, cutaway frock coat of blue faced with buff, buff waistcoat, close-fitting breeches, and gaiters. During and after the War of 1812, the infantry coat was a bluish gray with skirts cut away somewhat after the style of the present-day civilian evening coat, and breeches gave way to white or light-blue trousers. Broad bands of white crossing upon the breast supported the knapsack and other equipment, and the costume was topped off by a cylindrical hat with vizor and pompon. This uniform still survives with a few changes in the dress uniforms of the West Point Military Academy.

During the Civil War and Afterward

During the Civil War the uniform was of dark blue throughout. The cap was a French old-style "képi," the coat was loose and buttoned tight about the neck with a "turn-and-fall" collar, and loose trousers were worn, except in the mounted service. This uniform persisted throughout the next generation, save that the képi gave way to a gray slouch hat and the trousers were caught in below the knee by leggings.

Khaki appeared at the time of the Spanish-American War, and in 1902 the Army adopted the uniform which is essentially that still in use today throughout all arms and grades of the service. The dress uniform is of blue, dark for the coat and lighter for the trousers, with variations in headgear and ornaments for different degrees of formality. The service uniform is olive-drab—slightly darker than khaki—and is issued in wool serge for winter and cotton for summer wear. During the World War the use of the blue uniform was forbidden for any occasion except formal calls at the White House, and even in peace time the American military men generally prefer the olive-drab, with the prescribed modifications, for off-duty garb. The coat or "blouse" is snug-fitting, of medium length, with a stand-up collar and four patch pockets. Breeches, with wrapped woolen puttees for enlisted men and leather boots or leggings for officers, are used in all branches of the Army service.

Types of Hats and Caps

There are various types of headgear. The "garrison cap," generally used off duty, is made of the same material as the uniform, with a russet leather peak and circular flat top, higher in front than behind. Officers wear a bronze eagle above the vizor, and enlisted men have bronze buttons indicating their branch of the service. On duty the usual headgear is the broad-brimmed felt "campaign hat" with a colored hat-cord. In the presence of an enemy a "dishpan" steel helmet is substituted. During the World War the campaign hat gave way in France to a close-fitting cloth cap with ear-flaps.

Differences in rank and arms of the service are indicated by inconspicuous colored trimmings and ornaments. The different branches of the service use the following colors in trimmings: infantry, light blue; tank corps, gray; cavalry, yellow; artillery, scarlet; engineers, red and white; signal corps, orange and white; medical department, maroon and white; quartermaster department, buff; ordnance department, red and black; enlisted men on detached service of all kinds, green. These colors appear on the hat-cords worn by enlisted men on the campaign hat, and by all officers below the rank of general as trimmings on the blue dress uniform. Warrant officers and field clerks wear hat-cords of braided black and silver, commissioned officers below generals wear braided black and gold regardless of the arm of service, and general officers use gold both for hat-cords and dress uniform trimmings. Each arm also has a characteristic badge, which is worn on the collar of the coat or shirt.

Officers are distinguished from enlisted men by more closely cut uniforms, differences in collar ornaments and hat-cord, braid and eagle on the garrison cap, the presence of rank insignia on the shoulder of the coat and sleeve of the overcoat, and a stripe of olive-drab braid about the lower part of the coat sleeve. Enlisted men who held commissions during the World War may also wear this stripe.

Uniforms of the Marine Corps

The Marine Corps field uniform follows that of the Army in general characteristics, except that long trousers take the place of the army breeches. Its uniform cloth has a more greenish shade, however, and in place of the various badges indicating branches of Army service it employs a globe imposed upon an anchor as the distinguishing mark of the Corps. The blue uniform, corresponding to the Army "dress" garb, is also prescribed for certain varieties of ordinary duty. On "blues" the chevrons are large, of yellow cloth edged with red; the trousers, of lighter blue than the coat, have a broad red stripe down the seam.

What the Sailors Wear

Naval uniforms are much the same the world over. They are of blue serge for winter wear, and white duck for summer. The United States Navy coat for all grades above first class petty officers is a double-breasted tunic with turn-down lapels. Seamen wear a loose-fitting blouse, with a square collar falling down upon the back. All grades above first class petty officers wear trousers resembling those of civilians in pattern. The seaman's trousers have a "bell bottom" effect, so they may be instantly drawn above the knee for "wet" work. On certain kinds of duty, the trousers are caught in below the knee with white canvas leggings.

The cap for grades above first class petty officers is firmly shaped, with a black vizor and flat top. Seamen wear knitted arctic caps in winter known as "watch caps" and round white canvas hats with narrow brims turned up all around, or the blue "pancake hat" in summer. Enlisted men below the grade of chief petty officer wear reefers in winter, and all officers above that grade, both commissioned and non-commissioned, wear overcoats.

The grade insignia of the Navy are simpler than those of the Army. Commissioned grades are indicated

by the number and size of gold stripes worn on the lower sleeves of the coat and on the stiff black shoulder tabs of the overcoat.

Campaign and Service Ornaments

Before the World War, the United States authorities discouraged the practice of differentiating particular bodies of troops and excessive ornamentation. Men who participated in campaigns were allowed to wear on the olive-drab uniform when off duty a short strip of colored ribbon, of patterns prescribed for each campaign, and corresponding medals on the dress uniform. Medals for valor, or ribbons for them, could also be worn. During the war, however, various other ornaments were adopted. A gold chevron, point downward, on the lower left coat sleeve, may be worn for each six months of foreign service during the World War, and a silver chevron for each six months of wartime service in the United States. A similar gold chevron may be worn on the lower right sleeve for each wound received. Each division adopted a characteristic emblem, worn on the left shoulder. Divisional insignia are now prescribed for the regular army. The Marine Corps and Navy have similar insignia. Army enlisted men wear a diagonal cloth bar (on a blue background for the Regular Army and buff for the National Guard) on the lower left overcoat sleeve, for each three years of service. The service stripes of the Marine Corps are gold and of the Navy, red. Experience has proved that such insignia tend to promote pride in service.

THE UNITED STATES OF AMERICA

Its Geography—Its People—Its Industries

UNITED STATES OF AMERICA. It is because the United States is made up of every race under the sun that it is called "the great melting pot." The thin sprinkling of red Indians has long been almost lost to sight under the flood of immigrants from other lands. Puritans from England driven out by religious persecution landed on Plymouth Rock; the Dutch seeking trade came to New York; Swedes and English settled New Jersey; Quakers and German religious refugees founded Pennsylvania; proud English Cavaliers built up Virginia with the labor of negro slaves from Africa; Spaniards seeking golden treasures settled Florida, Texas, and California; and Germans, Austrians, Poles, and Irish for economic or political reasons settled the great Mississippi valley. On the Pacific slope and in the islands beyond is a medley of races—Malays, Japanese, and Chinese from the Orient; Spaniards recalling the days of old Spanish empire round the world; a sprinkling of descendants of Russians in Alaska—; and Italians, Jews, Slavs, Armenians, and Syrians are found in every considerable city in the great possessions under the Stars and Stripes. No country in the whole round world—not even Great Britain with its far-flung colonies in every clime—shows such a diversity of races and peoples.

Extent.—North to south, 1,598 miles; east to west, 2,807 miles. Area 3,026,789 square miles. Population (1920 census), 105,708,711; including Alaska and island possessions, 117,857,509.
Physical Features.—Atlantic Coastal Plain rising to the Appalachian Mountains; Central Plains with Great Lakes Basin to the north and Gulf Coastal Plain to the south; Great Plains; Cordilleran system of mountain ranges running north and south (highest point, Mt. Whitney, 14,502 ft.) and dropping abruptly to Pacific Ocean. Rivers and lakes: Hudson, Delaware, Susquehanna, James and Great Lakes—St. Lawrence system flowing into the Atlantic Ocean; Ohio-Mississippi-Missouri and Rio Grande, into the Gulf of Mexico; Colorado, into the Gulf of California; San Joaquin-Sacramento and Columbia, into the Pacific.
Products.—Corn, wheat, oats, cotton, hay and forage, fruits and vegetables; cattle and dairy products, hogs, sheep and wool, horses; coal, petroleum, natural gas, clay products, cement, iron, copper, lead, zinc, gold, silver, aluminum; lumber and timber; fish products; meat packing, textiles, steam and electric cars, iron and steel products (including machinery, foundry and machine-shop products), automobiles, clothing, flour and meal, petroleum products, boats and ships, bread and bakery goods, shoes, leather goods, and rubber goods, electrical machinery, chemicals.
Cities.—New York (5,600,000), Chicago (2,700,000), Philadelphia (1,825,000); Detroit, Cleveland, St. Louis, Boston, Baltimore, Pittsburgh, Los Angeles, Buffalo, San Francisco (over 500,000); Washington (capital, 438,000).

And all these peoples—with one exception—came seeking the same noble end: Freedom, Liberty for each man, woman, and child to work out the best that was in him, for his own good and the good of humanity. Even the hapless colored people brought to America as slaves were better off as slaves in the South than they would have been in their native Africa, preyed on by every warrior who had a spear or a club. Whether the "great experiment" of the American Republic succeeds or fails depends on every citizen's remembering what brought all the different races to America, and that in loyalty to his flag he is helping to realize a universal brotherhood of all races in Freedom and Self-government.

The land in which this experiment is being worked out is well fitted by nature for such an enterprise. It is too far removed from the Old World to be unduly influenced by it; and its variety of surface, soil, and climate make it largely independent economically. Its greatness and variety challenge the best powers of men, and afford better opportunities for vast multitudes of the common people than the world has ever seen before. Read the article on North America and you will understand better how its situation and surface favored the rapid growth of such great new peoples as the United States and Canada.

To the United States have fallen the most favored regions of the New World. Continental United States lies wholly within the temperate latitudes, the most favorable situation for the development of a high civilization. Its vast area—about equal to that of Europe—the fertility of its soil, and its inexhaustible mineral wealth have made it within a century and a half of national existence one of the foremost powers of

contained in the Easy Reference Fact-Index at the end of this work

the world. Though it is the world's greatest producer of both food and raw materials for manufactures, it has as yet reached only a fraction of the development of which it is capable. For every square mile of its area it has a population of only 36 persons, while England has nearly 700 persons to the square mile. You could set down all the people of the world in the continental United States and it would still be less crowded than the England of today, for its area is 3,026,789 square miles, or nearly 2,000,000,000 acres. With Alaska and its other possessions, its area is 3,621,550 square miles.

From West Quoddy Head in Maine (the easternmost point of the United States) due west to the Pacific Ocean the distance is 2,807 miles, and from the southernmost point of Texas due north to the Canadian border (the 49th parallel) it is 1,598 miles. The southernmost point of the mainland, however, is Cape Sable, Florida (49 miles farther south than any point of Texas). The westernmost point is Cape Alva, Washington, and the northernmost, a small detached land area bordering the Lake of the Woods in northern Minnesota. The boundary line with Canada is 3,898 miles long; with Mexico, 1,744 miles. The total coast line is nearly 12,000 miles long; 5,560 miles on the Atlantic, 2,730 miles on the Pacific, and 3,640 miles on the Gulf of Mexico.

Two Great Mountain Systems

The chief mountains of the United States consist of two great uplifted ridges running north and south, one close to the Atlantic coast, one close to the Pacific coast. The eastern ranges are known as the Appalachian system. The western are known as the Cordilleran. Neither system is a continuous long even line north and south. They are broken up in parallel ridges and cut across by lower levels called "passes" and "gaps," through which rivers tear down from the snows and rains of the mountains, presently to become the quiet broad streams of the farm plains as they flow out to the sea. (*See* Appalachian Mountains; Rocky Mountains.) In some places these ridges throw off lateral spurs running east and west, or slanting diagonally, such as the Olympics up in Washington or the Uintas in Utah. These irregular lateral spurs, which are sometimes loftier than the main mountains, as in Washington, throw the traveler off the straight line east and west and send rivers and railroads round great curves. The Columbia River has to turn two great curves like the letter S to push through the mountains down to the sea. The Sacramento has to flow almost due south and then, like a snake lazily turning its head, has to twist west to reach the Pacific.

The mountains in the east are far older than in the west, and so they have been worn down by the ages into mere fragments of what they were. Mount Mitchell, in North Carolina, 6,711 feet, is not half so high as Pikes Peak in Colorado, 14,108 feet, or the Mount of the Holy Cross, 13,978 feet. Washington and Oregon and California also have a dozen peaks twice as high as Mount Mitchell, such as Mount Shasta, with its great opal-colored dome, Mount Whitney, Fremont Peak, Mount Baker, and Mount Rainier.

The young rugged Cordilleran system is the wonderland of the United States. It abounds in scenes of marvelous beauty and grandeur, such as the Grand Canyon of the Colorado, the valley and falls of the Yosemite, the snow-clad peaks and eternal rivers of ice in Glacier National Park, and the steaming geysers of Yellowstone Park. Its principal group of ranges, the Rocky Mountains (6,000–14,000 feet), extends mainly through northern Idaho, western Montana and Wyoming, and central Colorado. The Rockies are separated from the Cascade Range (6,000–14,000 feet) in east central Washington and Oregon by the Columbia Plateau, from the Sierra Nevada (10,000–14,000 feet) of west and central California by the Great Basin, and from the Western Sierra Madre (5,000–8,000 feet) in central Arizona by the Colorado Plateau.

The "Great American Desert"

The high ranges between the Pacific coast and the plateaus bar out most of the moisture-laden atmosphere blowing in from the Pacific; so these plateaus were miscalled by the earliest explorers the "Great American Desert." They are not rainless, nor are they long flat areas of desert sands. They are upland valleys and table-lands, needing, for the most part, merely irrigation or scientific farming to make them produce in abundance. Some, lying 4,200 to 6,000 feet above sea level, are covered with sand and weathered lava. Others lying still higher are successions of valleys and mountains clothed in great yellow pine and spruce forests. The Columbia Plateau, covering most of southeast Washington, eastern Oregon, and southern Idaho, forms a large part of the Columbia River drainage basin, and it represents an ancient and enormous lava field in most of its extent. The Colorado Plateau of southwest Colorado, northwest New Mexico, southeast Utah, and northern Arizona is noted chiefly for its Grand Canyon (*see* Grand Canyon) of the Colorado River. The Great Basin is a remarkable section of the United States covering most of Nevada, the west part of Utah, and southeastern California. It is a region of interior drainage; that is the small rivers of the region either disappear into "sinks" or unite to empty into some interior salt sea or lake such as the Great Salt Lake of Utah. This region is also the scene of the mythical "Great American Desert," which is really confined to the small deserts of the Great Salt Lake Desert in northwest Utah and the Black Rock Desert in northwest Nevada, and the somewhat larger Mohave and Colorado deserts in southeast California. The only other desert in the United States is an arm of the Sonoran Desert of Mexico, known as the Gila Desert in southwest Arizona.

In addition to the ranges of the Cordilleras already mentioned there are the Coast Ranges (3,000–5,000 feet), lying very near to the ocean beach and extending north and south the full length of the Pacific coast.

The most important valleys are those of the Puget Trough, extending south from Puget Sound through Washington and Oregon and lying between the Coast Range and the Cascades; the valley of California in the central part of the state of that name and between the Sierra Nevada and the Coast Range; and a small district around Los Angeles.

Vast Stretch of Plain and Plateau

Between the ramparts of the Cordilleran system on the west and the Appalachian system on the east lies a great lowland area, a vast system of plains and plateaus a thousand miles wide. From the foothills of the Rockies the Great Plains slope gently to the Mississippi valley, from an elevation of about a mile above the sea to a few hundred feet. The Great Plains are continued eastward to the Appalachian Plateau by the Central Plains, a broad gently rolling region, mostly prairie, nowhere more than a few hundred feet above sea level. In the south these divisions merge into the great Gulf Coastal Plain, which comprises the greater part of the area of the states bordering on the Gulf of Mexico. The only important interruptions of this vast system of plains are the Black Hills of southwest South Dakota and northeast Wyoming, and the Ozark Plateau of Missouri, Oklahoma, and Arkansas.

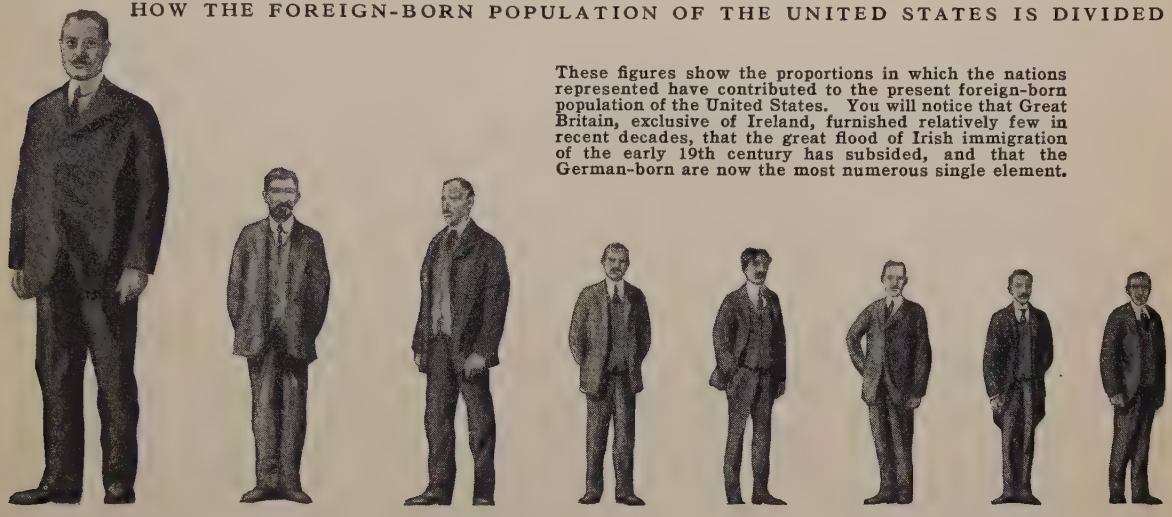
The mountains, both the old low mountains of the east and the rugged young giants of the west, were an important factor in compelling the first settlers to keep together in close communities. In the New England states, the mountains crowded the settlers in the narrow Coastal Plain between the sea and the mountain wall in an area only from 70 to 100 miles wide. The mountains protected these settlers from the Iroquois raiders in the west and kept them clearing the lands between the mountains and the sea till more than two million people from a dozen different countries in Europe had become as one people, speaking one language, working for one end. In the South Atlantic states, the mountains recede 250 miles from the sea, so the settlers here spread out from towns in big tobacco and cotton plantations up the river banks. This is one of the reasons why there were fewer cities in the South than in the North.

But when settlers had at last crossed the Appalachians into the Central Plains and the great Mississippi valley, conditions were reversed. There they found no mountains to protect them from Indian raids. The settlers advanced fighting for every inch of ground. In 1700, it is said, you could ride from Maine to Virginia and sleep in a settler's cabin every night; but even as late as 1800 you could float down the Ohio and the Mississippi from Pittsburgh to the French town of New Orleans on the Gulf of Mexico, and not see a cluster of settlers' cabins oftener than once a week. The settlements were spread far apart on the river banks; and these widely separated groups did not learn to work together with one aim till the great Civil War of 1861–65 united all sections of the country in one nation—now truly the "United" States.

But if the mountains were the barriers which confined the first settlers to the Atlantic seaboard, the rivers which broke through the mountain passes were the silver threads which guided the bold pioneers of later generations through the gaps and across the plains from the Atlantic to the Pacific. New Englanders and emigrants from lower New York pushed up the Hudson and across New York along the Mohawk, usually crossing to the Ohio and using its tributaries to reach their home sites. Settlers from the Middle States found an easy passage across the mountains by following the Potomac through the gap at Harper's Ferry, a route that was later used by the first railway to link the Mississippi with the eastern seaboard. The men from Virginia and the Carolinas who followed Daniel Boone's trail went up their rivers to the

HOW THE FOREIGN-BORN POPULATION OF THE UNITED STATES IS DIVIDED

These figures show the proportions in which the nations represented have contributed to the present foreign-born population of the United States. You will notice that Great Britain, exclusive of Ireland, furnished relatively few in recent decades, that the great flood of Irish immigration of the early 19th century has subsided, and that the German-born are now the most numerous single element.



Germany | Russia and Finland | Former Austria-Hungary | Ireland | Italy | Scandinavia | Great Britain | Canada

ridges, then through Cumberland Gap, whence they could float lazily down the Cumberland and Tennessee rivers to the land of plenty. More adventuresome hunters and traders paddled up the Mississippi and its great western tributary, the Missouri, carrying their traps and guns to the mountains, and, a generation later, across to the Columbia and down to the Pacific Ocean.

The Great Waterways and the Pioneers

In all, these early homeseekers could travel by water on navigable streams for 20,000 miles. As for the Great Lakes, these early pioneers could hardly believe they were not inland seas. The first explorers like Radisson and Marquette and La Salle really expected to find China and Japan just beyond the Great Lakes! Lake Superior is 400 miles long, almost as long as from New York to Buffalo. From the head of Lake Michigan to the foot of Lake Erie is a clear path of 1,000 miles; while from the Mississippi east and west run rivers for a distance of 14,000 miles, with arable clear parklike lands for an area of 1,240,000 square miles—a great farm basin two-thirds as large as European Russia.

Shut off by the mountains behind them, with faces set to the west, always fronting Indian attacks and French raids from Canada and Spanish intrigue from the south, what wonder that these settlers of the Mississippi Basin developed a new type of men and women, fearless, forgetful of all past history and nationality, a law to themselves, free as air, working like demons for the new opportunity for each man and woman to arise and possess the land and his or her share of wealth in that land? Strangers who come to America for the first time declare you never meet the true type of American till you cross into the great Mississippi valley. Here is the true melting pot of the whole world; and the rivers were the silver threads that led these New World argonauts to their destiny of founding a new nation.

The Mississippi and Missouri rank as the longest rivers in the world, 4,220 miles. The Rio Grande coming down from the mountains of Utah and Colorado, 2,000 miles long, and the Yukon threading the whole length of Alaska and part of Canada, 2,200 miles, rank as the next longest rivers in American territory. The Colorado and Green rivers flowing 2,000 miles to the Pacific, and the Columbia, half of which is north of the Canadian boundary, 1,400 miles, rank as the next longest open roads to the wilderness. While the Hudson is barely 350 miles and the Potomac 400, the importance of these rivers lay in the fact they led inland over the mountains like the James and the Roanoke. They were arrows pointed inland, making a path for the explorer.

How Little Mr. Beaver Helped Along

Every boy and girl has wanted to know on what the seven bright bands of the rainbow rested; and some little boys and girls have set off to chase the rainbow ends and find out. It was the same with the explorers and settlers of America. Camped at the river mouths they found Indians in skin tepees, with wonderful furs for clothing and rugs on their tent floors and beds. The furs in greatest use in Europe at that time were beaver for hatting, and ermine for royal robes; and the Indians traded their beaver and ermine in piles for colored beads, for knives, for iron awls and for trinkets. So the white men soon found they could come to America with shiploads of such cheap wares and go back loaded to the water line with furs that paid the cost of the voyage and left a handsome profit. The first settlers too had to have some goods to send back to Europe in exchange for the powder and firearms and ships and silks and tea and other things they could not yet make for themselves; and here were the Indians with priceless furs ready to trade them for trinkets. So while they farmed, the settlers also took time to trade in furs and to outfit canoes and boats to ascend the Hudson, the Delaware, and the other rivers.

And the little beaver that furnished this valuable fur was everywhere. Wherever the Hudson widened out into marshy flats as at Lake George and Lake Champlain, or where the Mohawk led back to the lake country of central New York, or the Delaware and Roanoke and James led back to marshy mountain meadows joining the headwaters of the rivers flowing down to the Ohio and Mississippi, there the little brown beaver had his wattled house of little sticks and logs and clay in millions. And there were more beaver colonies clear to Lake Superior and across the plains up to the Rockies, where the Colorado and the Snake and the Columbia led down to the Pacific.

The little beaver was the first bright color in the rainbow that led the settlers across the continent from Atlantic to Pacific. It kept the settler alive till he got his farm or his fisheries or his shipbuilding or his tobacco plantation going prosperously enough to support him.

Riches Free for all Men

When the little brown beaver had led the settler up the open silver road of the rivers across the mountains to the rivers flowing down the great plains to the Mississippi, the second band in the rainbow began to play its part. Here was the richest open free land men had ever seen in all the history of the world. "Why do nations fight for an arid rock in Europe," Radisson had asked in 1660, when he first beheld the Mississippi Basin, "when here is land enough for all men free to all men without fighting for it?" Why, indeed? It was from the Indians that the white settlers had first discovered the uses of tobacco and corn; and the great Mississippi valley would grow not only the Indian corn and tobacco, but also cotton and grains and vegetables. And the grasses that grow so abundantly on these plains would sustain cattle by the million. So the frontiersmen sat them down on the great plains and became settlers, instead of rovers. The corn and grain and grass lands of the plains held these wandering fur hunters down to mother earth at last; and only the more venturesome pushed on after the little brown beaver across the Rockies, or to

trade with the Spaniards of New Mexico 800 miles by the Santa Fe Trail from St. Louis.

Practically free land of great natural fertility capable of growing grain to support the world was the second band in the great rainbow of hope belting the New World.

As the settlers farmed, they found coal in great beds in Pennsylvania, in West Virginia, in Alabama, in Indiana, in Illinois, and in Ohio. They found iron at the head of the Great Lakes and copper in the Upper Michigan peninsula, and gold and silver and copper in the Rockies from Colorado and New Mexico and California through Utah and Nevada and Montana. Thereafter the forward push westward, ever westward, was not a leisurely hunt up the great river one year after furs and out the next year after goods. It was not a hurried rush for free land and a slow development of farms from a few acres of wheat and corn to full areas in crop, perhaps after 40 years of slow growth. The push west became a mad stampede for rich metal deposits. After the discovery of gold in California in 1848, settlement went forward faster west of the Mississippi in 50 years than it had gone east of the Mississippi in 250 years.

RELIGIONS IN THE UNITED STATES

This shows the comparative size of the denominations whose registered and published membership at the latest census exceeded one million.

Mines were the third band in the rainbow spanning the new nation.

The Rainbow's Fourth Band of Color

When the settlers entered the forests of the Alleghenies and the Adirondacks and the Cumberlands and even Wisconsin and Michigan, they found them an obstruction to settlement. They concealed lurking Indian foes. They hindered the planting of crops. They developed damp noxious atmospheres that caused agues and malarias. So the settlers ruthlessly slashed these forests, often setting great tracts on fire, to clear the land for farming. They left the forests standing only where they deemed the land too hilly or too rocky or too sandy for farming. In the east they left only patches of the old hardwood forests in Maine and the White Mountains and the Adirondacks and the Cumberlands.

But when the settlers poured into the Great Basin of the Mississippi, it was a different story. There they found no forests except in parklike clumps on the uplands or round the lakes. Whether the forests that once covered this region were burned off long aeons ago or destroyed by some glacial rush of waters or crowded out by the grasses which thrive more luxuriantly in the powdery brown soil of the prairies, science does not know; but every boy and girl knows that the 50,000,000 people living and toiling in the great Mississippi Basin need wood for houses, machinery, factories, barns, railroad ties, and a hundred other purposes. So the great forests of the Rocky Mountains and the Pacific slope became tremendously valuable, and about a generation ago the government began setting great areas aside as national forest reserves; and lumbermen, who had cut most of the timber in the southeast and in Michigan and Wisconsin, began moving their mills to the national forests of the mountains and the Pacific coast, where the trees grow so large that the lumber from a single big red cedar will build a ten-room house.

The timber of the national forests became a fourth band in the chase to the rainbow ends across the continent. Timber cruisers blazed trails through forests of Idaho and Washington and Oregon and California and Colorado and central Utah, where no fur trader had ever footed a path.

The bands of the rainbow now became strong with girders of iron and steel from the mines, and timber from the big forests. Lumber, burned as worthless down to 1870 and sold for $10 and $15 a thousand board feet in the '80's, became worth $30 and $40 a thousand in the early 1900's and double that price a few years later. Lumber became as valuable as the fur and the farm lands and the mines.

But we have not yet finished with the rainbow. "The sheep's wool which grew on trees in India," as the old traveler, Marco Polo, described cotton, had proved so profitable in the Southern states that the settlers had carried it with them across the Mississippi to Texas and Arizona. Cotton was added to the rainbow bands, weaving them stronger than ever.

But in the last half of the 18th century inventors in England had devised machinery which would spin and weave cotton far faster than human hands. The whirring wheels they set in motion created great cities crying for cotton, more raw cotton, for the people of Europe. And as the cities of Massachusetts grew larger and larger from shipping American goods to Europe and bringing back goods for the United States, they began to see it would pay them better to manufacture the cotton on this side of the ocean and ship it out in compact cloth form than to ship it out in big clumsy bales and buy back the manufactured goods at many times a higher price from European factories. Also they reasoned the same way about leather for shoes, about lumber, and about iron and steel. So

textile factories began to spring up all through Massachusetts, and machine factories and sugar-factories all through New York and New Jersey and Delaware and Rhode Island and Pennsylvania and Maryland; and flour mills to grind the wheat at Buffalo and Minneapolis; and farm machinery factories at Chicago and all through the Middle West to make the lumber and steel into farm implements; and steel mills at Pittsburgh and Cleveland and Chicago where the coal to make steel met the iron coming down the Great Lakes.

Putting the Waterfalls to Work

In the early days, wherever there was a waterfall, the settlers put up old-fashioned wooden water-wheels, such as you can see on countless little deserted streams all through the East; and with these water-wheels they drove the machinery that ground their wheat into flour. Presently they began to use coal to drive bigger and bigger machinery for bigger factories; and the old water-wheels began to be deserted. But now came another change—electricity. It was found that if you had a strong enough waterfall its power could be used to generate electricity that would drive any machinery that man could invent. So where there were waterfalls or where waterfalls could be created by great dams, bigger and bigger factories sprang up to manufacture forests into lumber and paper, cotton into dress goods, wool into clothes, iron into steel, and even nitrogen in the air into fertilizer for the farm; to drive street-cars and light cities. It cost millions of dollars to put in the great dams and build the great whirling turbine wheels; but once the plant was built, instead of shoveling coal to get the steam, the water had simply to be turned on the wheel and one man could do the work of four or eight.

Look at the map now! Cotton mills, woolen mills, canning factories, paper mills in New England wherever there were waterfalls. Factories on the upper reaches of the Hudson and the Mohawk. Cotton mills in the south, where there were both water-power and raw cotton. Fertilizer and aluminum factories at Niagara Falls; other aluminum factories where power could be tapped from the rapids and falls of the St. Lawrence; pulp mills where were water-power and pulpwood in upper New York and New England and Virginia; great smelting plants and quartz mills in the Rockies at the Great Falls of the Missouri; plants in the Sierras to impound waters for irrigation and at the same time to supply electricity for lighting houses and city streets, running street-cars, and driving the wheels of many industries.

Beaver, free land, mines, forests, cotton, factories—six bands of the rainbow binding East to West have now been found. But the seventh color in the rainbow was perhaps the most wonderful of all. It is very recent. It is barely half a century old; and it has poured liquid floods across the country of greater value in a year than all the gold of all the world in any year. It is worth nearly half the value of the greatest wheat crop the plains have ever produced. It is worth a fifth the value of the greatest corn crop the Mississippi valley has ever grown.

You recall the region in the far west once known as the "Great American Desert." Once it was considered an arid waste, but it has grown smaller and smaller every year until now almost every section of it can be made to produce something. Still there were spotted sections in this and other regions that seemed utter waste; areas in Pennsylvania and West Virginia that were neither farm land, nor coal lands; dry hard clay burned lands—where prehistoric forests had burned out the very humus of the ground—in Kansas and Oklahoma and Wyoming and Texas and southern California. It looked as if this were a foolish wasteful mistake; but Nature never makes mistakes. She hides her secrets and makes us dig for them.

The story of "the Oil Age in America" is too long to tell here (*see* Petroleum); but "gushers" were found in Pennsylvania, West Virginia, Kansas, Oklahoma, Texas, Louisiana, and southern California that spouted from 25,000 to 100,000 barrels a day. Pipe lines were built to carry it to the refineries, where it is distilled into kerosene, paraffin waxes, gasoline for motors and tractors and airplanes and submarines, coarse fuel oil for engines on trains and naval ships and great merchant vessels. And, oddly enough, some of the greatest oil gushers were found in those waste sections where white men had selfishly thrust Indian tribes like the Osages, because the lands were considered too worthless for white man's use. Today, those Osage Indians have greater yearly revenues to the family from oil wells than the salary paid the president of the United States; and to the credit of "the great white father" let it be said that the government of the United States has left them in possession of their lands and administered the revenues from the oil drillers so that the Indian gets his lawful share of the wealth.

The Rainbow of the Future

The beaver, the free lands, the mines, forests, cotton, factories, and oil—the yellow-green band—there is the rainbow belting East to West, making life easier, freer, happier for all the sons and daughters of all the races of men who came to this new land seeking opportunity and freedom to bring out the best that was in them. The rainbow that Noah saw augured hope and promise that the earth would not fail to produce food and shelter and clothing for all time for those who dwelt thereon. So does the rainbow of these seven bands, across the New Republic of the United States.

Back in the 17th century when the first settlers began moving up the rivers from the Atlantic coast, it took a three months' trip by canoe or woodland trail to get across the Alleghenies and the Blue Ridge and the Great Smokies and the Cumberland Ridge. And when the pioneers began going up the Platte and the Missouri from St. Louis between 1789 and 1820, along what later became known as the Oregon Trail, by flat-bottom boat and packhorse and wagon, 2,700 or 2,800 miles to the Columbia, it was considered

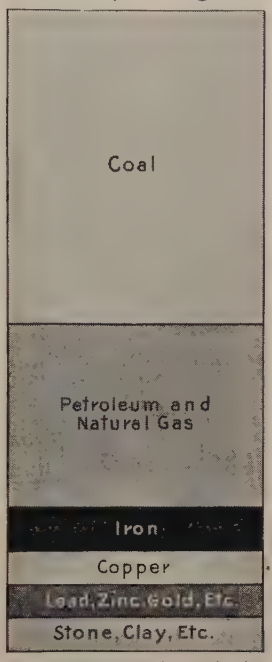
UNITED STATES
SCALE OF MILES
0 50 100 200 300
Capitals of Countries
Capitals of States and Provinces
C.S. HAMMOND & CO., N.Y.
Longitude
West
ALBERTA
SASKATCHEWAN
MANITOBA
BRITISH COLUMBIA
WASHINGTON
OREGON
CALIFORNIA
IDAHO
NEVADA
MONTANA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NORTH DAKOTA
SOUTH DAKOTA
NEBRASKA
KANSAS
OKLAHOMA
TEXAS
Seattle
Portland
San Francisco
Los Angeles
San Diego
Las Vegas
Salt Lake City
Denver
Albuquerque
Phoenix
Tucson
El Paso
Dallas
Houston
Chicago
New Orleans
Atlanta
Boston
New York
Washington
Montreal
Toronto
Winnipeg
Vancouver
Victoria
Calgary
Edmonton
Regina
Saskatoon
Hermosillo
Chihuahua
Monterrey
Guaymas
Mazatlan
Topolobampo
Parral
Escalon
Torreon
Matamoros
Laredo
Eagle Pass
Del Rio
Presidio
Juarez
Nogales
Ensenada
Tia Juana
Yuma
Needles
Bakersfield
Fresno
Sacramento
Reno
Boise
Spokane
Billings
Missoula
Great Falls
Helena
Butte
Yellowstone Nat. Park
Pacific Ocean
Gulf of California
Rio Grande
Colorado R.
Columbia R.
Snake R.
Missouri R.
Mississippi R.

95 G 90 H 85 J 80 K 75 L 70 M
from 95 Greenwich G 90 H 85 J Key West 80 K 75
CANADA
ONTARIO
QUEBEC
MAINE
NEW BRUNSWICK
MINNESOTA
WISCONSIN
MICHIGAN
IOWA
ILLINOIS
INDIANA
OHIO
KENTUCKY
MISSOURI
ARKANSAS
TENNESSEE
MISSISSIPPI
ALABAMA
GEORGIA
LOUISIANA
FLORIDA
SOUTH CAROLINA
NORTH CAROLINA
VIRGINIA
WEST VIRGINIA
PENNSYLVANIA
NEW YORK
VERMONT
N.H.
MASS.
CONN.
R.I.
N.J.
DEL.
MD.
LAKE SUPERIOR
LAKE MICHIGAN
LAKE HURON
LAKE ERIE
L. ONTARIO
ATLANTIC OCEAN
GULF OF MEXICO
Albany R.
Lake Nipigon
Rainy Lake
Port Arthur
Ft. William
Kenora
Lake of the Woods
International Falls
Red Lake
Virginia
Duluth
Moorhead
Itasca L.
Brainerd
Mille Lacs
St. Cloud
St. Paul
Minneapolis
Red Wing
Winona
Mankato
Rochester
Eau Claire
Green Bay
La Crosse
Appleton
Oshkosh
Fond du Lac
Sheboygan
Milwaukee
Madison
Janesville
Beloit
Racine
Kenosha
Mason City
Sioux City
Ft. Dodge
Dubuque
Cedar Rapids
Davenport
Iowa City
Des Moines
Council Bluffs
Oskaloosa
Ottumwa
Burlington
Keokuk
Rockford
Freeport
Aurora
Elgin
Joliet
Chicago
Rock Island
Moline
Galesburg
Kankakee
Peoria
Bloomington
Champaign
Springfield
Decatur
Jacksonville
Quincy
Lincoln
Hannibal
St. Joseph
Atchison
Kansas City
Jefferson City
St. Louis
E. St. Louis
Belleville
Ft. Scott
Pittsburg
Parsons
Carthage
Joplin
Springfield
Eureka Springs
Tulsa
Muskogee
Ft. Smith
Hot Springs
Little Rock
Pine Bluff
McAlester
Denison
Paris
Texarkana
Dallas
Marshall
Tyler
Palestine
Shreveport
L. Providence
Monroe
Vicksburg
Jackson
Meridian
Laurel
Natchez
Hattiesburg
Alexandria
Baton Rouge
Beaumont
Houston
Lake Charles
Galveston
New Orleans
Mouths of the Mississippi
Pascagoula
Hammond
Mobile
Mobile Bay
Pensacola
Panama City
Apalachicola
C. San Blas
C. St. George
Tallahassee
Valdosta
Thomasville
Waycross
Dothan
Montgomery
Selma
Talladega
Anniston
Birmingham
Columbus
Tuscaloosa
Bessemer
Gadsden
Florence
Corinth
Huntsville
Memphis
Jackson
Nashville
Columbia
Chattanooga
Knoxville
Cumberland Mts.
Cumberland R.
Cairo
Paducah
Bowling Green
Middlesboro
Louisville
Evansville
New Albany
Jeffersonville
Frankfort
Lexington
Indianapolis
Cincinnati
Covington
Newport
Terre Haute
Lafayette
Muncie
Anderson
Richmond
Danville
Springfield
Jacksonville
Quincy
Hannibal
Kankakee
Logansport
Gary
South Bend
Ft. Wayne
Kalamazoo
Grand Rapids
Muskegon
Saginaw
Bay City
Flint
Lansing
Jackson
Ann Arbor
Detroit
St. Clair
Pontiac
Traverse City
Manistique
Escanaba
Marquette
Houghton
Calumet
Sault Ste. Marie
St. Marys R.
Lake Superior
Ashland
Superior
Duluth
Mackinaw
Straits of Mackinac
Manitoulin I.
Georgian Bay
Lake Huron
Lake Michigan
Lake Erie
Lake Ontario
Toronto
Hamilton
London
Niagara Falls
Buffalo
Rochester
Syracuse
Oswego
Albany
Utica
Schenectady
Troy
Binghamton
Ithaca
Elmira
Jamestown
Erie
Meadville
Oil City
Williamsport
Sharon
New Castle
Youngstown
Akron
Canton
Cleveland
Toledo
Sandusky
Lima
Marion
Wheeling
Springfield
Columbus
Dayton
Marietta
Grafton
Clarksburg
Parkersburg
Huntington
Charleston
Cumberland
Hagerstown
Harrisburg
Lancaster
Johnstown
Altoona
McKeesport
Pittsburgh
Washington
Alexandria
Baltimore
Annapolis
Dover
Wilmington
Philadelphia
Atlantic City
Reading
Easton
Trenton
Jersey City
Newark
New York
Scranton
Wilkes-Barre
Poughkeepsie
Newburgh
Patterson
Bridgeport
New Haven
Hartford
Springfield
Worcester
Providence
Fall River
New London
Boston
Cape Cod
Nantucket
Martha's Vineyard
Long Island
Portland
Biddeford
Portsmouth
Concord
Manchester
Nashua
Lowell
Lawrence
Augusta
Auburn
Lewiston
Bangor
Mt. Desert I.
Calais
Eastport
Caribou
Fredericton
St. John
St. John R.
St. Lawrence R.
L. St. John
Quebec
Three Rivers
Montreal
St. Hyacinthe
Sherbrooke
Valleyfield
Ottawa
Hull
North Bay
L. Nipissing
Ottawa R.
Cobalt
L. Abitibi
Rapid Lake
Lake Champlain
Lake George
Adirondack Mts.
Green Mts.
White Mts.
Connecticut R.
Hudson R.
Mohawk R.
Delaware R.
Susquehanna R.
Potomac R.
Chesapeake Bay
Delaware Bay
C. May
Cape Henlopen
Ocean City
Salisbury
Easton
Annapolis
Norfolk
Portsmouth
Newport News
C. Henry
C. Charles
Richmond
Petersburg
Lynchburg
Roanoke
Danville
Alleghany Mts.
Blue Ridge Mts.
Shenandoah R.
Roanoke R.
Albemarle Sound
Pamlico Sound
C. Hatteras
C. Lookout
C. Fear
Wilmington
Fayetteville
Raleigh
Durham
Greensboro
Winston-Salem
Charlotte
Asheville
Spartanburg
Greenville
Columbia
Augusta
Savannah R.
Savannah
Aiken
Georgetown
Charleston
Beaufort
Savannah
Brunswick
Fernandina
St. Johns R.
Jacksonville
St. Augustine
Palatka
Gainesville
Ocala
Titusville
C. Canaveral
Lake City
Tallahassee
Waycross
Altamaha R.
Flint R.
Chattahoochee R.
Apalachee Bay
Tampa
St. Petersburg
Tampa Bay
Indian R.
Lake Okeechobee
Fort Myers
West Palm Beach
Palm Beach
The Everglades
Miami
C. Romano
C. Sable
Florida Bay
Florida Keys
Key West
Dry Tortugas
Florida Strait
Great Bahama
Great Abaco I.
Bahama Islands
New Providence I.
Nassau
Cat I.
Eleuthera I.
Andros I.
Rio Grande R.
Corpus Christi

almost a miracle to cross to the Pacific one year and come back the next. When the steel path of the railroad first crossed the continent it was thought that the limit had been reached, that men would never cross the continent in less than 12 days; but the little steel paths began taking short cuts, bridging rivers, avoiding detours round rocky mountain ledges by tunnels, cutting across shallow lakes to avoid going round them, and the time decreased to less than five days from ocean to ocean. It was as if the rainbow had been belted across its diameter at the base by steel girders.

But today even greater miracles are accomplished. Winged ships with engines of incredible power roar through the great open spaces of the sky three times as fast as the fastest train on rails. The airplane can travel so much faster and so much straighter, high above all obstructions, that as soon as stations enough are built across the continent to provide it with gasoline and quick repairs for used machinery, it will be possible to cross the continent east to west in 30 hours.

We'll suppose an air traveler sets out from somewhere near New York to take a tour of all the lands under the Stars and Stripes. He takes with him a little boy of an inquiring turn of mind, who has never traveled before. High in the air, the little passenger looks down on New York Harbor. It is a tremendous sight. Here men have built straight up into the air instead of spreading out. The buildings rise four times higher than Niagara Falls. Running in and out of the city are hurrying trains on the little steel rails like swift shuttles; and dashing through the canyons of the narrow city streets are so many thousands of horseless carriages that the little passenger grows dizzy wondering how many there are. And then the harbor! That is the most wonderful of all. Over the silver blue waters glide the ships, swiftly, silently, most with smoke from steam coal engines, but many with no smoke at all; for they use oil in their engines. They, too, are like shuttles weaving strands of trade in a warp and woof across the Atlantic to Europe. The pilot tells the little boy that before the World War of 1914–18, only a few of these vessels hung out the Stars and Stripes. Now perhaps half of all the vessels in the harbor fly the Stars and Stripes. When the war took the foreign vessels out of trade, Uncle Sam had hurriedly to build his own ships to keep the shuttle weaving trade back and forward with the world. Away out on Newark Bay, away out on Staten Island, up at Fore River, Boston, which they see a little later, down on the Delaware when they come back that way, the little boy sees the big shipbuilding plants that won the race against the German submarines. (*See* Ships.)



The relative value of the minerals produced in the United States.

There is another kind of vessel, too, not like the merchant ships, under the Stars and Stripes—great gray low-lying fellows with gun turrets. These are the ships of Uncle Sam's navy, and the little passenger is told that the American navy is now the second strongest in the world. (*See* Navy.)

Then as the airplane speeds up the Hudson and along the Mohawk, the young traveler sees many other beehive cities, crowded with people of all races, hurrying, hurrying, with the shuttle trains dashing in and out. The pilot explains to him that cities are nothing but big trading and manufacturing marts where men come to barter something they have for something they haven't, or to turn raw material into manufactured goods. Afterwards, when the air trip carries him above Boston and Buffalo and Pittsburgh and Cleveland and Youngstown and Chicago and St. Paul, Minneapolis, and Seattle and San Francisco and St. Louis and Kansas City and Omaha and New Orleans and Birmingham and Mobile and Savannah and Charleston and Baltimore and Philadelphia, he sees in every case that this is the explanation of the crowded city. In Massachusetts, the cities are making shoes and woolen and cotton goods. In New York and New Jersey they are making clothing and ships and shoes and leather and silks and sugar and chemicals. In Delaware and Rhode Island and Pennsylvania, they are making leather and woolen and cotton goods, steel and machinery and chemicals. In the South, they are making cotton cloth and tobacco products and sugar, cottonseed oil and feeds for stock, and fertilizer for farms, and steel. In the Middle West, they are making leather and farm machinery; they are packing pork and beef, refining petroleum, and grinding flour. On the Pacific coast, they are making lumber and canning fruit and fish and building ships.

By the time the pilot has explained all this, the travelers have passed over Buffalo and Cleveland, those immense exchange marts, where the big boats of the Lakes exchange cargoes of grain and iron ore for cargoes of steel and coal and manufactured goods. The way those great vessels load and unload makes them gasp. Here is a vessel with 300,000 bushels of grain, the grain from 10,000 acres, unloaded in ten hours, pouring its golden flood of grain into chutes of great elevators that later pour it into flour mills, or into box cars to be shipped away to Europe.

There is no time to stop at Detroit, but they can see below the largest motor factories in the world, turning out thousands of cars a day. Who will use all these cars? The little boy discovers as soon as they are above the great plains of the Mississippi. Here are 50,000,000 people needing motors for country roads

and city boulevards, trucks for hauling, tractors for farms. He knows now what made Chicago a second New York. It is where all the little steel rails bring the trains rushing across the prairie with the beef and the hogs for the great meat-packing plants. It is where fleets of giant freighters come to discharge their cargoes of iron ore and lumber from the North. It is the great mart for the farmer, who sells, and the manufacturer, who buys. It is the meeting place of East and West, rail and ship, the farmer, who grows food, and the city workers, who eat it.

And when he sees the farm lands of the great Mississippi valley, our little explorer's head swims with marvel and wonder. He isn't afraid of those immense cities going hungry, at least for a long time, especially if the farms grow thicker as fast as the city beehives grow higher and larger.

Across the Valley of Golden Fields

The wheat fields are golden ripe in the sunshine, more than 70,000,000 acres of them. If they were spread out in one big farm of mile-square fields, there would be 100,000 such fields and it would take the owner on a ride of 400,000 miles just to go along the edge of all his fields and look over the fence of each; and if the golden dollars from a bumper wheat crop at $1.50 a bushel were piled straight up in the air, they would make a pile a billion dollars high, equal in value to one-third of all the gold known to exist in the whole world.

But the corn is still more wonderful with its tufted tassels and scent of heavy flowers, more than 100,000,000 acres of it. A man riding round these corn fields in blocks of 640 acres would have to ride 700,000 miles—20 years' steady riding at the rate of 100 miles a day. And if the corn dollars at 75 cents a bushel were laid edge to edge in a straight line they would extend twice around the earth!

And then the beef and pork and mutton and the milk and butter and eggs! The pilot tells the little boy that these trains shuttling in and out of Chicago and Omaha and Kansas City carry 20 billion pounds of meat a year—enough for 60,000,000 people for a year. The cows he has seen pasturing on the clover in the East, on the bunch grass in the Middle West, and on the blue grass in Tennessee, would give 34,000,000 people a quart of milk apiece every day in the year, and all the butter they want.

The Hen and Her Record

The millions of busy feathered workers he has seen scratching for their living round the corn shocks and wheat stacks and in neat poultry runs lay nearly two billion dozen eggs a year. If ten eggs contain as much nourishment as a pound of meat, how many people could live on the eggs of the farm hen? But here the little boy grows dizzy. He isn't afraid of anybody being hungry any more forever and ever. It is the promise of the rainbow. He feels very grateful too to the 6,450,000 farmers and their families who feed all the 106,000,000 people of the 48 states.

We haven't time to follow his flight down the Pacific coast; but when he comes back across the South, he is wonderfully interested in "the wool growing on trees," the cotton fields that supply two-thirds of all the cotton in the world. If the cotton fields were all put in one big farm, some years it would cover more than 35,000,000 acres, half the usual extent of the wheat fields, just a third of the corn fields. Then the boy and the pilot do a little mental arithmetic. They add up all the crops of all the farms, and find they are worth between $10,000,000,000 and $15,000,000,000 a year—five times all the gold in the known world! And then they understand why the farm is the richest and best paying mine in the world.

Now our travelers would like to cross the Pacific and visit Hawaii, Guam, and Samoa, and the 3,000 islands of the Philippines with their pineapples and sugar and hardwood forests; but the pilot says that ships would have to go ahead with gasoline. It would be nearly as difficult to go up to Alaska, though airplanes have done it; so the little boy contents himself with hearing about the wonderful glaciers—one of them with 1,500 square miles of ice fields—and the dozen great volcanoes spouting actively every few years. They decide to come back from the Pacific by way of Panama. Though that is one of Uncle Sam's narrowest bits of territory, it is one of his most valuable strips; for it connects the two great oceans by a cut straight through the mountains. (*See* Panama Canal.)

The Ships that Cross the Continent

What interests him here is not so much the great cut of the Canal across the Isthmus as the ships laden with iron and nuts and sugar and hemp and nitrates and lumber and oil and coffee and pineapples and oranges and coconuts going to the Atlantic, laden with machinery and cement and clothing and manufactures going to the Pacific. At each end of the Canal glide the great low-lying gray war-vessels guarding the passage from attack—"patrolling the zone" they call it; and here are the most wonderful tall steel towers of coal and tanks of oil he has ever seen. They are like the grain elevators of Buffalo and Chicago and Minneapolis—300,000 tons of coal they keep on hand; and here is coal being run down into the holds of the great ships at the rate of 2,000 tons an hour. If you paid men to shovel that coal, it would cost $1,600 an hour.

Again the pilot decides that it is too long a "jump" to visit America's island possessions in the West Indies. While they are lunching, however, he tells the little boy about the beautiful green Virgin Islands with the wonderful harbor at St. Thomas standing like a sentinel to the eastern approach to the Panama Canal. Close by is Porto Rico with its sugar and tobacco and coffee fields, with its groves of giant palms and its tropical forests, and with its million and a quarter of industrious people. (*See* Porto Rico; Virgin Islands.)

As they are flying up the Gulf to the great steel cotton docks and sheds of New Orleans, the little boy tries to understand why so many classes of people can

IMPORTANT FACTS ABOUT EVERY STATE IN THE UNION

State	Total Area, Square Miles	Rank in Area	Population	Rank in Population	Date of Admission
Alabama	51,998	28	2,348,174	18	1819
Arizona	113,956	5	333,903	45	1912
Arkansas	53,335	26	1,752,204	25	1836
California	158,297	2	3,426,861	8	1850
Colorado	103,948	7	939,629	33	1876
Connecticut	4,965	46	1,380,631	29	Original state
Delaware	2,370	47	223,003	46	Original state
Florida	58,666	21	967,470	32	1845
Georgia	59,265	20	2,895,832	12	Original state
Idaho	83,888	12	431,866	42	1890
Illinois	56,665	23	6,485,280	3	1818
Indiana	36,354	37	2,930,390	11	1816
Iowa	56,147	24	2,404,021	16	1846
Kansas	82,158	13	1,769,257	24	1861
Kentucky	40,598	36	2,416,630	15	1792
Louisiana	48,506	30	1,798,509	22	1812
Maine	33,040	38	768,014	35	1820
Maryland	12,327	41	1,449,661	28	Original state
Massachusetts	8,266	44	3,852,356	6	Original state
Michigan	57,980	22	3,668,412	7	1837
Minnesota	84,287	11	2,387,125	17	1858
Mississippi	46,865	31	1,790,618	23	1817
Missouri	69,420	18	3,404,055	9	1821
Montana	147,182	3	548,889	39	1889
Nebraska	77,520	15	1,296,372	31	1867
Nevada	110,690	6	77,407	48	1864
New Hampshire	9,341	43	443,083	41	Original state
New Jersey	8,224	45	3,155,900	10	Original state
New Mexico	122,634	4	360,350	43	1912
New York	49,204	29	10,384,829	1	Original state
North Carolina	52,426	27	2,559,123	14	Original state
North Dakota	70,837	16	645,680	36	1889
Ohio	41,040	35	5,759,394	4	1803
Oklahoma	70,057	17	2,028,283	21	1907
Oregon	96,699	9	783,389	34	1859
Pennsylvania	45,126	32	8,720,017	2	Original state
Rhode Island	1,248	48	604,397	38	Original state
South Carolina	30,989	39	1,683,724	26	Original state
South Dakota	77,615	14	636,547	37	1889
Tennessee	42,022	34	2,337,885	19	1796
Texas	265,896	1	4,663,228	5	1845
Utah	84,990	10	449,396	40	1896
Vermont	9,564	42	352,428	44	1791
Virginia	42,627	33	2,309,187	20	Original state
Washington	69,127	19	1,356,621	30	1889
West Virginia	24,170	40	1,463,701	27	1863
Wisconsin	56,066	25	2,632,067	13	1848
Wyoming	97,914	8	194,402	47	1890

live in peace together. There are 4,000,000 people of the Irish clan, and counting the 2,000,000 Canadians, not less than 5,000,000 of the British clan, and 6,000,000 of the German clan, and Norwegians and Swedes and Finns and Poles and French and Spaniards and Italians and Mexicans and Filipinos and Negroes and native American Indians—and a dozen others.

How do they all live in peace and prosperity together in Uncle Sam's big mansion of many, many rooms? The pilot explains it is because the Stars and Stripes everywhere fluttering to the breeze protects each and every class alike. The clans all come seeking freedom; and that flag is the emblem of freedom to the whole world, not freedom to split the nation up into old clans, but freedom to pursue "life, liberty, and happiness" as citizens of the United States.

And now after taking this bird's-eye view of the United States with our youthful explorer, let us part company with him and glance rapidly at a few more of the outstanding facts about the country.

The climate as a whole is of the "continental" type (*see* Climate), with extreme variations of temperature. These variations are greatest in the vast central trough lying between the two mountain systems. Minnesota, for instance, has had temperatures of more than 100° above zero in summer and more than 40° below in winter. This wide range of temperature is largely explained by the fact that this central trough stretches unbroken the whole length of the continent from the Gulf of Mexico to the Arctic Ocean, thus presenting, so to speak, an open doorway to the heat of the tropics and the cold of the Arctic regions.

contained in the Easy Reference Fact-Index at the end of this work

A second controlling factor in determining the climate is the fact that the prevailing winds are westerly. The Pacific coast enjoys a mild and equable climate because of the moderating influence of the winds blowing from the Pacific Ocean, but the Atlantic coast suffers far greater extremes, because the winds coming from the interior of the continent are warm in summer and cold in winter. The great differences in rainfall between various parts of the country are also partly explained by the westerly direction of the winds, which deposit most of their moisture before crossing the mountain barrier. In the northwest on the coast there are torrential rains, amounting to as much as 100 inches a year, but farther south the amount of rainfall rapidly lessens, especially in southern California. Inland the rainfall becomes extremely variable, ranging from less than 10 inches in most of the Great Basin to more than 30 inches in some favored localities of the Rockies. On the Great Plains the annual rainfall varies from about 15 to 25 inches. The eastern half of the United States is well watered, since it draws its moisture from the Atlantic Ocean, the Gulf of Mexico, and the Great Lakes, and also because there are no intervening ranges of high mountains to interfere with an even distribution. (For rainfall map *see* North America.)

The Kings that Rule the Great Republic

The well watered Central Plains and the Atlantic and Gulf Coastal plains lead in the production of agricultural wealth. It is thanks to them that agriculture is America's greatest industry from the standpoint of the number of persons engaged.

King Corn rules in the Central Plains. His dominion is the greatest farming section of the whole world, for King Corn is a benevolent monarch and generously shares his kingdom with others. Indeed, some of his vassals are greater than the rulers of other sections. This, for instance, is true of wheat, cattle, swine, oats, hay, butter and eggs, all of which are produced in the Central Plains in greater quantities than in any other region of the United States.

King Cotton rules in the South. His chief domain is in the "Black Belt," so called from the color of its soil. This consists of the southern part of the Atlantic Coastal Plain, beginning with South Carolina, and nearly all of the Gulf Coastal Plain with the exception of the peninsula of Florida. Here we find a long growing season, a rich soil, plenty of rain, a moderately warm climate—the conditions that King Cotton likes best. This monarch has been a rather despotic ruler in the past, grudgingly sharing his domain with rice, sugar, tobacco, corn, and cattle. The word has gone forth, however, from the leading citizens of the South that the farmers should diversify their crops more largely. King Cotton is in no danger of being overthrown, but he must shortly take his place alongside King Corn as a limited monarch.

On the Great Plains, King Wheat holds sway. He, too, is not wholly benevolent, for he is a soil robber. Too much successive cropping in wheat impoverishes the soil, and so the word has gone forth that the Great Plains farmer too must diversify his crops and raise more live stock. King Wheat is especially adapted to this region of limited rainfall. Certain varieties of wheat, especially the red winter and hard wheats, which were introduced from the dry steppes of Russia, are fitted to produce a crop on a minimum amount of moisture. Likewise the United States Department of Agriculture has introduced certain kinds of drought-resisting non-saccharine sorghums from Africa, such as milo maize and kafir corn, that are already staple crops in the southern part of the Great Plains.

Throughout most of the Cordilleran system, with the exception of the Pacific coast, King Cattle rules. In the early days his sway was undisputed, but of late years a powerful rival, Sheep, has threatened his throne. Indeed, there are now more sheep raised in the Cordilleras than in all the rest of the United States. Irrigation is also wresting great sections of his domain from him for diversified farming. The government irrigation projects alone have reclaimed nearly 2,000,000 acres. These lands formerly worth not more than $20,000,000 are now worth $250,000,000 and the cost of reclaiming them was not more than half of their present value. The crops annually amount to about $100,000,000, for the soils are wonderfully rich because the essential fertilizer salts have not been leached out by excessive rains. In other sections of insufficient rainfall western farmers obtain astonishing results by their careful methods of dry farming.

On the Pacific coast King Fruit has his golden throne. He is represented in the north chiefly by the famous apples of Oregon and Washington, in the south by the wonderful oranges of California, and in central districts by the raisin grape and the prune plum. California is the favorite state of King Fruit. There are other noted fruit regions such as Florida with its great golden clusters of grapefruit, western Michigan with its peach and apple belt, and the south shore of Lake Erie, often called the grape belt. New England and the Atlantic Coast Plain are also widely known for their production of small fruits.

New Lands for Wheat and Cotton

Two of these kings have established distant territories. King Wheat has found a region especially to his liking in the Columbia Plateau. Here is a practically inexhaustible soil, 30, 40, and even 100 feet deep, composed of ancient lava and volcanic ash. King Cotton has picked an isolated region on the Gila and Salt rivers in southwest Arizona for an especially choice variety of long staple cotton.

Besides furnishing homes for nearly half of the population and providing much of the world's food and raw material for clothing, the domains of King Corn, King Cotton, King Wheat, King Cattle, and King Fruit include more than one-half of the continental United States—about 500,000,000 acres in improved farm lands, and 750,000,000 acres in range or unimproved pasture lands. In addition much of the forest and woodlands is used for grazing. Iowa leads

GREAT INDUSTRIES OF THE UNITED STATES

Each of the vast industries represented here has an annual output valued at more than a billion dollars. Slaughtering and meat-packing and the various textile industries lead all the rest, both in value of product and in the number of persons employed. These and the other manufacturing industries not only supply nearly all the wants of the United States, but also send their products to every part of the world.

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as a farming state, with more than 95 per cent of her area in farms. (*See* Agriculture; Corn; Cotton; Dairying; Poultry; Wheat, etc.)

The forests of the United States occupy somewhat more of its surface than the improved farm lands —about 550,000,000 acres. The evergreen forests are in the northern Appalachian Highlands, the Cordilleran system, northern Michigan, Wisconsin, and Minnesota, and the South Atlantic and Gulf Coastal plains; the hardwood forests are mainly between the Atlantic Ocean and the Mississippi River. The chief supply of timber now comes from the Southern forests, where about 10,000,000,000 feet of the Southern yellow pine are cut yearly. Next comes the Northwest, where more than 5,000,000,000 feet of Douglas fir are cut each year. Other important evergreen woods, furnishing timber, chiefly for building, are white pine, Western yellow pine, hemlock, and spruce, of each of which more than a billion feet are cut yearly. Most of the valuable hardwoods have become quite rare. Oak, the chief remaining one, furnishes about 2,000,000,000 feet a year. To protect the remaining timber stand great national forest reserves have been established. (*See* Conservation; Forests and Forestry.)

In mineral resources the United States is the most richly endowed region in the world (*see* Minerals; *also* articles on the chief minerals). Coal is widely distributed and is mined in 30 states. The principal fields are the anthracite region in Pennsylvania, the high grade bituminous coals throughout the southern Appalachian Highlands and under much of the Central Plains, the low grade bituminous coals scattered in the Rockies, and the lignites in the South and in eastern Montana and western North Dakota. The United States has 50 per cent of the world's visible future coal supply and produces nearly one-half of the present supply.

In oil and gas, which come next to coal in order of importance, the United States again leads, producing about two-thirds of the world's output of oil. When the oil wells are exhausted—their average life is about 30 years—the United States can then turn to its enormous supply of oil shales, from which oil can be extracted. In the production of iron, the most useful of all metals, the United States is also first. The best field is that around Lake Superior in northern Michigan and Minnesota, and that of next importance in the southern Appalachians, especially in northern Alabama. Many of the fields lie close at hand to important coal areas.

Gold, Silver, Copper, Lead, and Zinc

Two states of the Union, Arizona and Montana, produce about one-third of the world's supply of copper. Utah and Michigan are also important producers, the latter being famous for its deposits of the native metal. In gold the United States ranks second, and it is first in silver. Gold occurs in the southern Appalachians, but is chiefly found in the Cordilleras. An important field is the Black Hills. Silver is also found throughout the Cordilleran system, frequently in connection with lead and copper ores. California, Colorado, Nevada, and South Dakota lead in gold production, while Montana, Utah, Idaho, Nevada, Arizona, and Colorado are the chief silver states. The most important lead and zinc field is found in the Ozark Plateau. There is another great field in southwest Wisconsin and northwest Illinois. Building materials are widely distributed. Clay for brick and pottery is found in every state; limestones and granites come chiefly from the Appalachian states, slates chiefly from Maine, and marble chiefly from Vermont.

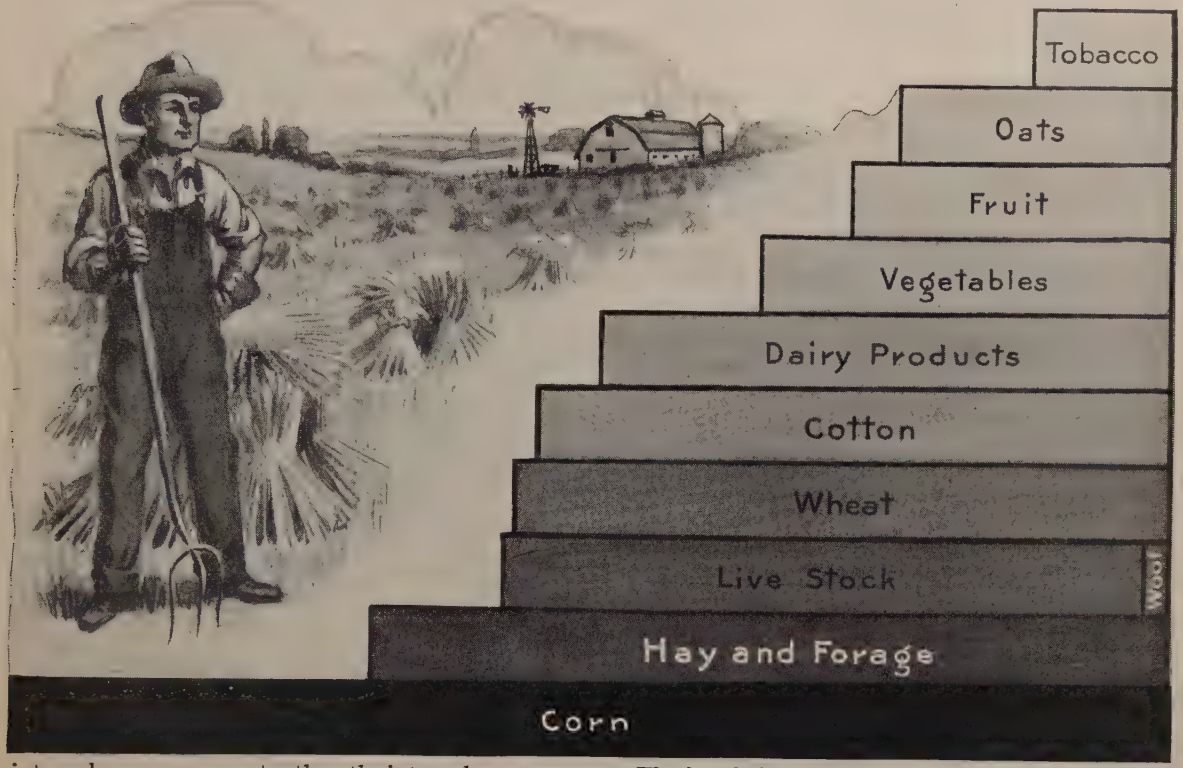
In nature's third great gift, the fish and other sea food, the United States again leads, as it does in agricultural and mineral products. The fish best adapted for the food of man are found in the cooler waters; consequently the chief fishing grounds are north of the Carolinas on the Atlantic (haddock, halibut, mackerel, and herring), north of San Francisco on the Pacific (salmon), and in the Great Lakes (whitefish, lake herring, lake trout). The most valuable fisheries product, oysters, comes chiefly from the Chesapeake and Delaware bays and Long Island Sound. The best lobster fisheries are off the coast of Maine. (*See* Fisheries.)

The Transformation in the Mills

But immense as is the wealth in raw materials with which nature has endowed the United States, it has to yield to the value of the products which human ingenuity and skill manufacture from these raw materials. The total value of the products of farm, mine, forest, and fisheries is only about half the value of the manufactured products, which form from 65 to 70 per cent of the total production of the country. The chief classes of manufactures, all of which have passed the billion dollar mark in yearly production, are wholesale slaughtering and meat packing, textiles (cotton, woolen, silk, and linen goods), steam and electric cars, iron and steel products of steel works and rolling mills, automobiles, men's and women's clothing, foundry and machine-shop products, flour and grist-mill products, petroleum products, boats and ships, bread and bakery goods, boots and shoes, rubber goods, and electrical machinery. The wholesale meat packing industry (*see* Meat Packing) leads in value, with an output of more than $4,000,000,000 in a single year, while the textile industry employs the greatest number of people. More than three-fourths of these manufactures are produced in the North Atlantic and East North Central states, but of recent years the South has developed many industries, notably cotton and steel and iron. Manufactures are steadily increasing too in the sparsely populated West.

Hand in hand with the industrial expansion of the nation has gone the development of its railways and waterways, the indispensable handmaidens of progress. In railway mileage (270,000 miles) the United States leads the nations, and it has 20,000 miles of navigable waterways. (*See* Canals; Great Lakes; Mississippi River; Railroads.) Over these avenues passes a flood of

THE RELATIVE VALUE OF UNCLE SAM'S CHIEF FARM PRODUCTS



internal commerce greater than the internal commerce of France, Germany, and the United Kingdom together, and equal in value to the combined imports and exports of all the countries of the world. In proportion to population the internal trade of the United States is far greater than that of any other nation, because the standard of life is higher; Americans spend more for food, clothing, and the comforts and luxuries of life than any other people.

In foreign trade the United States ranks as one of the great factors of world commerce. Much of this trade is with its nearest neighbors, Canada, Mexico, the West Indies, and Central and South America. Asbestos, printing paper, wood pulp and pulp wood, and wheat are imported from Canada; petroleum and copper from Mexico; sugar and iron ore from Cuba; tropical fruits, coffee, and cacao from Central America; coffee and crude rubber from Brazil; wool and hides from the Argentine; and copper from Peru and Chile. From the Orient come silks, rice, tea, tin, gums, fibers, and vegetable oils. From Europe come chiefly manufactured articles. In return for these the United States exports a great variety of products—cotton, breadstuffs, meat and dairy products, iron and iron manufactures, petroleum, lumber and lumber products, copper, tobacco, and leather. The commanding position of the United States in the world's trade is shown by the fact that the exports normally exceed the imports by about three billion dollars, thus making it a "creditor" instead of a "debtor" nation.

The last half-century has seen an amazing change in the character of the country's foreign trade. Where it once exported chiefly foodstuffs and raw materials to be manufactured in other countries, manufactures now form about half of the exports. And, on the other hand, where manufactures once composed two-fifths of its imports and raw materials for manufacture only one-sixth, these two classes have reversed their positions, raw materials now forming two-fifths and manufactured goods only one-sixth of the imports. About one-half of the imports are foodstuffs and raw materials from tropical and sub-tropical countries.

The Millions that Make Up "Uncle Sam"

In population, the United States with its 105,708,771 people (117,857,509 including Alaska and island possessions) ranks third in the family of nations, after China with some 400,000,000 and India with about 300,000,000. More than 78 per cent are native-born whites, 11 per cent are foreign-born whites, 10 per cent are negroes, and the others (chiefly Indians and Asiatics) compose less than half of one per cent. One-quarter of the population is in the North Atlantic states, one-third in the North Central states, one-third in the Southern states, and one-twelfth in the West. The average density is 35.5 to the square mile. Rhode Island and Massachusetts are the most densely populated, with 566.4 and 479 respectively to the square mile. The center of population, according to the 1920 census, is in Owen County, Ind., eight miles southeast of Spencer. The rate of growth

for the country as a whole has fallen from 21 per cent for the 1900–1910 decade to 14.9 per cent for 1910–1920, chiefly as a result of the decline in immigration (*see* Immigration).

Less than half of the people (48.1 per cent) live on farms and in rural communities; 51.9 per cent are found in towns and cities with more than 2,500 population. Of this urban population about half are grouped in a comparatively few great metropolitan areas. First of all comes the New York City district, composed of New York City proper, with three other New York state cities, three in Connecticut, and 25 in New Jersey. Here we have a population of about 10,000,000 that makes practically a single economic unit. About the Boston harbor is a metropolitan area of 1,000,000 people. Around Narragansett Bay is the state of Rhode Island, which is practically one great urban unit of about two-thirds of a million. At the head of Delaware Bay is the Philadelphia urban district of 2,000,000 persons. At the head of Chesapeake Bay are another million, centering in Baltimore, and 250,000 people cluster around Hampton Roads, Va., with Norfolk as the chief city. The Mohawk Valley in New York contains many urban centers. On the Pacific coast the population gathers about the great ports in metropolitan areas including from 500,000 to 1,000,000 people. On Puget Sound are the cities of Seattle and Tacoma, and Portland lies near the mouth of the Columbia River. San Francisco and Oakland are the largest of the cities about San Francisco Bay. Although it has no adequate natural harbor, Los Angeles forms a gateway to the Southwest and has become a great economic center.

Chicago and her neighbors, with their 4,000,000 people, form an economic unit second only to that of New York. Other centers on the Great Lakes are Cleveland with more than a million, and the somewhat lesser cities of Buffalo, Toledo, Milwaukee, and Duluth. In the Mississippi River valley are New Orleans, St. Louis, Minneapolis and St. Paul, Kansas City, Omaha, and Pittsburgh, all urban districts with populations ranging from 250,000 to 1,000,000.

LARGEST CITIES OF THE UNITED STATES

City	Population 1920 Census	Rank
New York, N. Y.	5,620,048	1
Chicago, Ill.	2,701,705	2
Philadelphia, Pa.	1,823,779	3
Detroit, Mich.	993,678	4
Cleveland, Ohio	796,841	5
St. Louis, Mo.	772,897	6
Boston, Mass.	748,060	7
Baltimore, Md.	733,826	8
Pittsburgh, Pa.	588,343	9
Los Angeles, Calif.	576,673	10
Buffalo, N. Y.	506,775	11
San Francisco, Calif.	506,676	12
Milwaukee, Wis.	457,147	13
Washington, D. C.	437,571	14
Newark, N. J.	414,524	15
Cincinnati, Ohio	401,247	16
New Orleans, La.	387,219	17
Minneapolis, Minn.	380,582	18
Kansas City, Mo.	324,410	19
Seattle, Wash.	315,312	20
Indianapolis, Ind.	314,194	21
Jersey City, N. J.	298,103	22
Rochester, N. Y.	295,750	23
Portland, Ore.	258,288	24
Denver, Colo.	256,491	25

The FUNDAMENTAL LAW *of the* NATION

How It was Drafted by Washington, Franklin, and other Notable Statesmen—The Bitter Conflict over Ratification—Its Provisions Summarized

UNITED STATES, CONSTITUTION. The name "United States" means simply the states that were united. There were states before there was a United States. These states, before they became states, were the colonies settled in America, mainly by Englishmen in the 17th century, and until 1776 parts of the British Empire. When the thirteen colonies declared themselves independent of Great Britain, each colony established a government of its own and so became a state by itself. In order to win their independence they had to unite their forces, and in order to maintain it they had to remain united for certain purposes. It was this union of the thirteen states for certain purposes that created a Federal government, in addition to the state governments; and it was this union that gave to the country its name—the United States of America.

Before the colonies became independent they were united under the British government; but they also found it useful to unite in their own way for certain special purposes. In 1643 the New England colonies of Massachusetts, Connecticut, New Haven, and Plymouth formed the New England Confederation, chiefly to defend themselves against the Indians. In the 18th century, during the French and Indian wars, the idea of forming a union was often discussed; and in 1754 a congress of deputies was held at Albany, N. Y. A "plan of union" prepared by Benjamin Franklin was discussed, but the colonies were too jealous of one another to enter into any binding agreement. "Everyone cries a union is absolutely necessary," said Franklin, "but when it comes to the manner and form of the union, their weak noddles are perfectly distracted." In 1765, when the British government laid a stamp tax on the colonies, a Stamp-Act Congress was held in New York which passed certain resolutions of protest against taxation by the British Parliament.

But the real union of the colonies began Sept. 5, 1774, when the First Continental Congress assembled at Philadelphia to unite the colonies in support of Massachusetts in her opposition to the coercive acts. This Congress drafted the association which bound the colonies to act together in refusing to trade with Great Britain until the coercive acts were repealed. The Second Continental Congress, which met at Philadelphia in May 1775, was the common government under which the colonies fought the Revolutionary War. It raised a Continental army, negotiated treaties of alliance with foreign countries, issued paper money, and exercised such other powers of government as the various states were ready to submit to.

After the colonies declared themselves independent of Great Britain, the Continental Congress prepared the Articles of Confederation (1777) and submitted them for approval to the several states. Maryland, which had no claims to land beyond the Alleghenies, refused to ratify until the states which had such claims ceded their western lands to the general government. The Articles of Confederation, at last approved by all the states in 1781, provided for a Congress to recommend laws, but not for a president or other executive power to enforce them. The recommendations of Congress could be carried out in any state only by the government of that state. The states, moreover, failed to agree to plans which would give the government needed revenue. Congress found itself helpless to enforce upon the states the provisions of the peace treaty of 1783 regarding fair treatment for the Tories; and upon Great Britain regarding surrender of western forts. Presently the states themselves were threatened with anarchy owing to hard times, and in Massachusetts Daniel Shays started a poor men's rebellion against the state authorities (1786–87) which caused much alarm (*see* Shays' Rebellion). A government which could not enforce its own laws fell into contempt; and in 1786, when the union of the states seemed on the point of dissolving, a movement was started to revise the Articles of Confederation.

The Constitutional Convention at Philadelphia

In the following year there was assembled at Philadelphia a Constitutional Convention on the call of Congress. It was one of the most notable bodies in American history. George Washington was its presiding officer, and it included such statesmen as the aged Franklin and James Wilson from Pennsylvania, James Madison and Edmund Randolph from Virginia, Alexander Hamilton from New York, Roger Sherman from Connecticut, William Paterson from New Jersey, and Charles Pinckney from South Carolina—in all 55 members, with Rhode Island the only state absent. The convention sat from May 25 to Sept. 17, 1787, its proceedings being in secret. There were long and hot debates, and agreement was reached only after a number of compromises—chiefly over slavery and the conflicting interests of large and small states. When the Constitution was at last signed, Franklin said, speaking of a picture of the sun behind the presiding officer's chair, that he had "not been able to tell whether it was a rising or a setting sun; now I know that it is the rising sun." A bitter conflict followed before ratification was obtained by the nine states necessary to put the new plan in operation, for men like Patrick Henry, Richard Henry Lee, and Elbridge Gerry feared lest the liberties of the people would be sacrificed under a consolidated government ruled by the rich and well born. Indeed, when the government under the Constitution began, in 1789, with Washington as the first president, Rhode Island and North Carolina were both outside the Union.

The Three Departments of Government

The new Constitution provided for three departments of government: a congress to make laws; a president to enforce them; and a judiciary to interpret them. In theory, if not always in practice, the three branches are coördinate; each branch has powers which neither of the others can take away, and each acts independently of the others, subject to limitations which are explained elsewhere (*see* United States, Government).

Congress consists of two chambers, the Senate and the House of Representatives. The House of Representatives was intended to represent the people, and it was therefore composed of members to serve for two years, chosen in each state by those who had a right to vote for members of the lower chamber of the legislature of that state, each state sending a greater or less number of representatives according to the population of the state. The Senate was intended to represent the states, and was therefore composed of two members from each state, to serve for six years, and elected by the legislature of the state (*see* Congress of the United States).

This arrangement was the result of a conflict between the large and the small states. Large states, like Virginia, wished to have an influence in the new government in proportion to their size and population; while the small states, like New Jersey, wished to have as much influence as the large ones. So to satisfy the large states the representation in the House of Representatives was distributed among the states according to population, while the representation in the Senate was made the same for all.

The men who framed the Constitution were afraid that the new government would become tyrannical, and so they very carefully restricted its powers in accordance with the following principle: "The powers not delegated to the United States by the Constitution, nor prohibited by it to the states, are reserved to the states respectively, or to the people." This means that Congress can pass laws only in respect to certain matters which are enumerated in the Constitution. Congress can levy taxes and customs dues, coin and borrow money, regulate foreign and interstate commerce, make naturalization and bankruptcy laws, punish counterfeiting, establish post-offices and post roads, determine copyright and patent right, establish Federal courts, declare war, define and

punish piracy, raise and support armies and navies, call forth the state militia to suppress insurrection and repel invasion, make all laws for the District of Columbia, and "make all laws which may be necessary and proper for carrying into execution the foregoing powers." The Congress also governs the territories of the United States, and admits new states into the Union. Its powers have been somewhat increased by subsequent amendments, and also by a broad construction of the "necessary-and-proper" clause just mentioned.

The Selection of the Chief Executive

Laws made by Congress are executed by the president. The men who made the Constitution were afraid of giving the people too much power, and so they wished to have the president chosen by a select group of prominent people. The Constitution provides that "each state shall appoint . . . a number of electors, equal to the whole number of senators and representatives to which the state may be entitled." These electors were then to ballot for two persons; the one receiving the highest number of votes was to be president, and the next highest, vice-president. If no one had a majority of votes, the House of Representatives was then to choose the president and vice-president from the five men who had received the highest number of electoral votes.

This method did not work as it was intended. The two political parties soon adopted the practice of nominating their candidates beforehand, and the electors chosen by either party then voted for the candidates nominated by that party; and now, since the electors are chosen by the people, and since each party nominates its own list of electors as well as its own candidate for president, the people really vote for and elect the president.

The duties of the president are in general to execute and administer the laws made by Congress. Besides, the president makes treaties with foreign powers, appoints ambassadors and justices of the Supreme Court, and other officers of the United States whose appointment is not otherwise provided for in the Constitution. But treaties and appointments thus made must be approved by the Senate, in the case of treaties by a two-thirds vote. In addition the president has the power of vetoing laws passed by Congress, although by a subsequent vote of two-thirds majority in each house the Congress may pass a law over the president's veto.

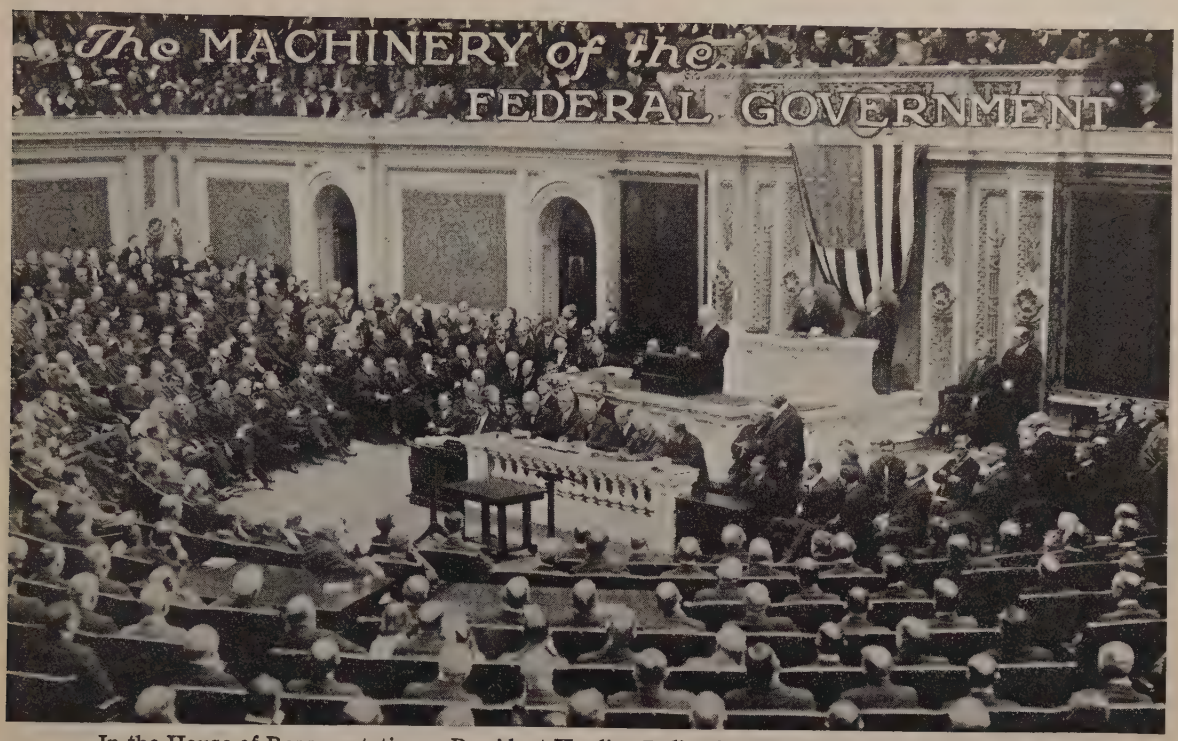
The Powerful Federal Judiciary

The Constitution provides for a Federal judiciary which shall consist of "one Supreme Court and such inferior courts as Congress may from time to time ordain and establish." The chief duty of the Federal courts is to try "all cases in law or equity arising under the Constitution, the laws of the United States, and treaties made . . . under their authority." The Supreme Court is thus, as the name indicates, the final court of justice for settling disputes arising out of the laws of the United States.

But it has another important power. Since the Congress of the United States has only such legislative powers as are enumerated in the Constitution, while the state legislatures have all legislative powers not granted to the United States or not prohibited to them by the Constitution, it is always possible that the Congress or a state legislature may pass laws that are in violation of these provisions of the Constitution. Who is to decide when the Congress or a state legislature has exceeded its powers? This duty has by custom been assumed by the Supreme Court. Anyone may refuse to obey a state law or a law of Congress, and may plead in defense that the law is "unconstitutional." Such cases have often come before the Supreme Court, and the Supreme Court has often pronounced both state laws and laws of Congress null and void because they are in violation of the Constitution. Throughout American history the Supreme Court has generally been inclined to interpret the Constitution in such a way as to give the Congress a great deal of legislative power—more by far than the framers of the Constitution intended it to have. The result has been that Federal power has greatly increased, while state power has diminished.

Amendments to the Constitution

This result has also been brought about by amending the Constitution. Amendments may be proposed by a two-thirds vote of both the Senate and House of Representatives, or by a constitutional convention when requested by two-thirds of the state legislatures. In either case such proposed amendments become parts of the Constitution when ratified by the legislatures or by conventions in three-fourths of the states. There are 19 such amendments in all. The first 10, which went into effect in 1791, were chiefly intended to remove the fears of men like Patrick Henry and Richard Henry Lee by safeguarding the people against arbitrary arrest and imprisonment, and to prevent the new government from abolishing freedom of the press, freedom of religion, and the right of jury trial in criminal cases. The 11th amendment, adopted in 1798, forbade the Federal courts to try cases brought against a state in the Union by citizens of another state or by citizens of a foreign country. The 12th amendment, adopted in 1804, required the electors to vote separately for president and vice-president. The next three amendments were adopted at the close of the Civil War: the 13th abolished slavery; the 14th and 15th were designed to prevent the state governments from depriving the colored race of the rights of citizenship. During more recent years four additional amendments have been made to the Constitution: the 16th permits the Federal government to levy a graduated income tax; the 17th requires the states to elect their senators by direct popular vote instead of by the state legislatures; the 18th prohibits the manufacture, sale, importation, or exportation of intoxicating liquors for beverage purposes; and the 19th gives to women the same right of voting as men possess in any state.



In the House of Representatives—President Harding Delivering His First Message to Congress

UNITED STATES, GOVERNMENT. The government devised by the makers of the Federal Constitution was unlike that of any other country of that time, though the founders built in part on English precedents and their own colonial experience. According to this Constitution the central government controls only certain matters mentioned in that document. Things that are purely local in their nature they left in the main under the control of the several states. Usually in speaking of the government of the United States we do not include these purely local matters, but refer only to the affairs of the Federal government centered at Washington.

The makers of the Constitution went further than merely dividing powers between the states and the nation. As stated in the article on the Constitution, they divided the authority of the nation among three distinct departments equal in importance—the legislative, the executive, and the judicial; and to guard against one encroaching on another they devised an elaborate system of checks and balances. The executive department, at the head of which stands the president, can check by its veto the hasty legislation of Congress. In return Congress can interfere with executive policies by refusing to vote the money to carry out the president's plans, by withholding the necessary approval of the Senate to the president's appointments, and finally by trying the president by impeachment in case he is guilty of usurpation or other "high crime or misdemeanor." (*See* Impeachment.) The dignified judiciary, which applies and interprets the laws passed by Congress, has ample means of protecting itself from undue interference by other departments.

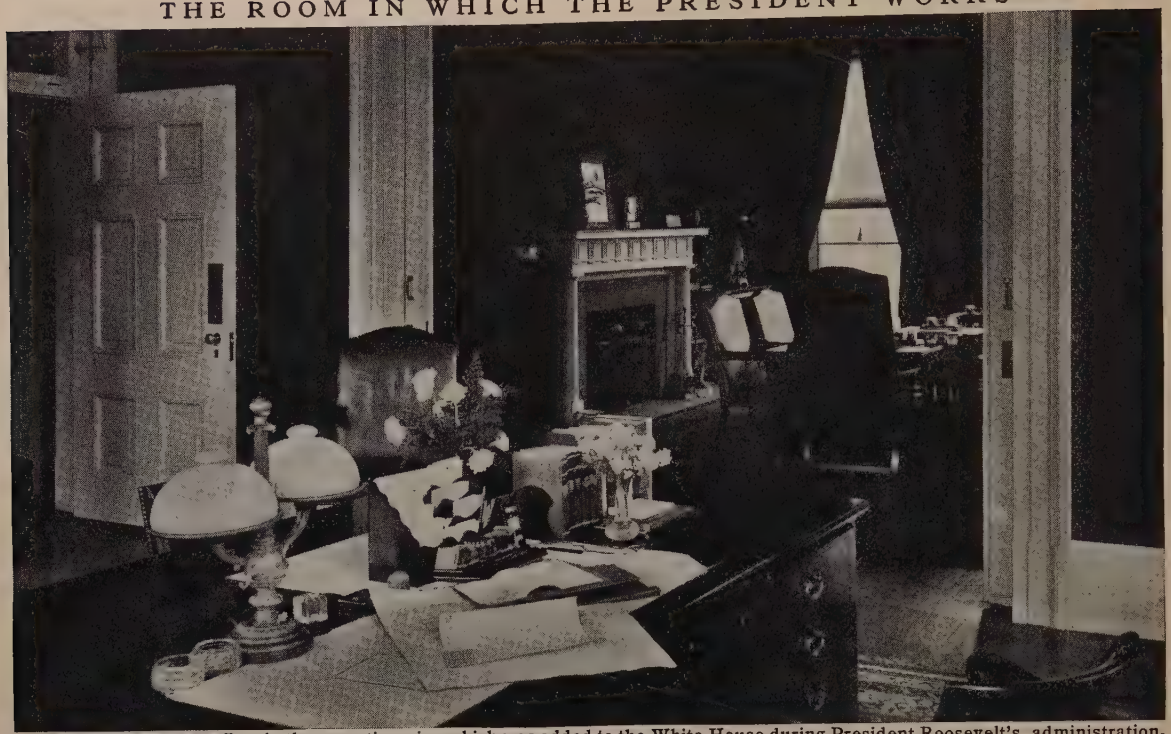
By inevitable growth and development, the United States government today performs functions never dreamed of by Washington, Madison, and their associates in the Philadelphia convention. Uncle Sam is engaged now in great irrigation projects and other government activities in areas that in 1789 were foreign soil. He appropriates money from the Treasury to aid various branches of education in the states, discourages child labor in products which pass in commerce and interstate commerce, and watches over the welfare of his younger citizens in factories. His Public Health Service guards the health of the whole nation, his agents watch over the purity of food and drugs, and he withholds from his people by prohibition habit-forming drugs and alcoholic liquors. He aids the farmer, the manufacturer, and the merchant by supplying useful printed information and by conducting the parcels post and postal savings banks. He even carries on an insurance business to supply insurance at low cost to the soldiers and sailors who served during the World War.

The Branches of Government

To keep the huge machine of Federal government going, the services are required of more than half a million men and women, and the expenditure of several billions of dollars each year.

The largest section of this machinery is the executive branch, consisting of the president, the heads of

THE ROOM IN WHICH THE PRESIDENT WORKS



This is the President's office, in the executive wing which was added to the White House during President Roosevelt's administration. Here he receives visitors of every kind, private citizens, members of Congress and of the executive departments, foreign diplomats, and everybody who comes to see him on official business. This room has none of the show and pomp which are associated with government in many other nations. The chief executive of 118,000,000 people works in a room which has the simplicity and dignity of a private home.

the War, State, Navy, and other departments (whose heads form the Cabinet and are the president's advisers) and all their various assistants. Here is the place where the great growth of the government is most clearly seen. True, Congress numbers many times as many members today as it did in 1789, but this is an increase growing out of increases in population and in the number of states. In the judicial system there are more courts and judges, but that also is linked with the increase in population. The enormous growth in the numbers and duties of the executive branch, to the present complicated scheme, is the result not merely of the growth in population, but still more of the ever widening scope of action of modern government.

Today there are ten great executive departments, each under a member of the Cabinet. In Washington's time there were only four—the secretary of state, secretary of treasury, postmaster-general, and attorney-general. And the number of important bureaus, boards, commissions, services, and other offices under these departments, or under the president independent of the organized departments, runs up considerably over a hundred.

Uncle Sam's Relations with Other Nations

The men and women in the executive branch are the cogs in the wheels of the machinery of government. If a cog slips, the machine is thrown out of gear and serious consequences may follow. It may result in a war with another nation, or it may only mean the delay of a letter from one of your friends.

If a war is the consequence, the slip may have been made in the Department of State, which represents the United States in its relations with foreign nations. This department employs the smallest force of any department of the Federal government, but it is first in rank. If both the president and vice-president should be unable to serve at any time as chief executive of the country, the secretary of state would take the place as acting president if he possessed the constitutional requirements. If not, it would pass to the secretary of the treasury, and so on down the list of cabinet officers, in an order established by law.

Most of the employees of the Department of State reside abroad. They are the ambassadors, resident ministers, and other diplomatic servants who represent America politically in the capitals of foreign nations, and the consuls who look after the trade relations in other countries and states.

In the State Department office in Washington a staff of translators is kept busy over the many communications received in foreign tongues. If these relate to political relations they are cared for by the chief of the Diplomatic Bureau. If they relate to commerce they may be referred to the director of the Consular Service, or if they are very important, to the foreign trade adviser. When these officials need detailed knowledge of the country with which they

HOW THE EXECUTIVE DEPARTMENTS ARE ORGANIZED

WAR

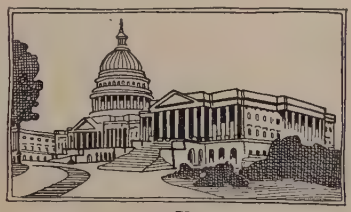
General Staff
Chief of Coast Artillery
Adjutant-General
Inspector-General
Judge-Advocate General
Quartermaster-General
Surgeon-General
Chief of Engineers
Chief of Ordnance
Chief Signal Officer
Militia Bureau
Director of Air Service
Bureau of Insular Affairs
Board of Engineers for Rivers and Harbors

AGRICULTURE

Weather Bureau
Bureau of Animal Industry
Bureau of Plant Industry
Bureau of Chemistry
Bureau of Entomology
Bureau of Crop Estimates
States Relations Service
Bureau of Public Roads
Bureau of Markets
Office of Farm Management
Biological Survey
Bureau of Soils
Forest Service

NAVY

Office of Naval Operations
Office of Naval Intelligence
Bureau of Navigation
Division of Naval Militia Affairs
Bureau of Yards and Docks
Bureau of Ordnance
Bureau of Construction and Repair
Bureau of Steam Engineering
Bureau of Medicine and Surgery
General Board
Marine Corps
Judge-Advocate General



JUSTICE

Assistant Attorneys-General
Solicitors for Departments
Division of Investigation
Superintendent of Prisons

INTERIOR

General Land Office
Office of Indian Affairs
Bureau of Pensions
Patent Office
Bureau of Education
Geological Survey
Reclamation Service
Bureau of Mines
National Park Service
Alaskan Engineering Commission

LABOR

Bureau of Immigration
Bureau of Naturalization
Bureau of Labor Statistics
Children's Bureau
U. S. Employment Service

STATE

Foreign Trade
Consular and Diplomatic Services
Western European Affairs
Latin-American Affairs
Mexican Affairs
Far Eastern Affairs
Near Eastern Affairs
Foreign Intelligence

TREASURY

Director of the Mint
Comptrollers of Currency and Treasury
Treasurer of United States
Bureau of Engraving and Printing
Bureau of Internal Revenue
Federal Farm Loan Bureau
Public Health Service
Budget Bureau
War Risk Insurance
Customs Service and Coast Guard
Secret Service

POSTOFFICE

Postoffice Service
Railway Mail Service
Foreign Mails
Money Orders and Stamps
Registered Mails
Postal Savings
Rural Mails
Dead Letters

COMMERCE

Bureau of Census
Bureau of Standards
Bureau of Fisheries
Bureau of Lighthouses
Bureau of Foreign and Domestic Commerce
Coast and Geodetic Survey
Bureau of Navigation
Steamboat Inspection Service

This chart shows the chief functions and divisions of each of the ten executive departments through which the President of the United States administers the affairs of the nation. The heads of these departments are appointed by the President and constitute his Cabinet. This complicated division of executive authority has been a matter of long development. At first there were but four executive Departments, State, War, and Treasury, with the Attorney-General. The Navy Department was created in 1798, Postoffice in 1829, Interior in 1849, Agriculture in 1889, and Commerce and Labor in 1903. The latter was divided into two departments in 1913. In addition to these chief executive departments, a number of minor bodies have been created to perform certain other duties. Among these are the Federal Trade Commission, United States Tariff Commission, Civil Service Commission, Federal Reserve Board, Railroad Labor Board, and United States Shipping Board.

contained in the Easy Reference Fact-Index at the end of this work

are dealing they refer to the chief of the division of the section concerned—Western European, Near Eastern, Far Eastern, Mexican, or Latin-American, as the case may be.

The vast mass of information coming to the office is carefully sifted and from it are prepared items for newspapers in this country and abroad. But much of the data collected is either confidential or is uninteresting to the public. The latter heading includes records of the marriages of American citizens in foreign lands, the birth of American children abroad, and like items, which are carefully reported and recorded in the Department of State. The department also issues passports to American citizens who wish to travel abroad, and such information as that mentioned is sometimes of importance in establishing the right to American citizenship.

Only one function of the Department of State concerns affairs in America alone. That is the publication of the proclamations of the president, of proclamations of treaties, amendments to the Constitution, the laws passed by Congress, the admission of new states, and the like. In the State Department also are kept the original copies of the Declaration of Independence, the Constitution of the United States, and all Federal laws.

The Work of the Treasury Department

The Treasury Department, which ranks next to the State Department, has control of all the national finances—the revenues and expenditures—and handles more money than any other one institution on earth. It is the most complex and extensive of all the executive departments of the government, having branches in many of the principal cities, and more than 5,000 employees in Washington alone. Though the Treasury building is huge, it is inadequate for housing this vast department, and an annex, a large modern office building, has been erected directly across the street.

Visitors to the Treasury building are often shown the great rooms and vaults where hundreds of millions of dollars of the nation's currency are stored. Huge piles of silver and gold coins are here stacked and hundreds of vault pigeonholes are stuffed with bundles of new paper money, bonds, etc., ready to be issued. This vast banking and accounting house of Uncle Sam is one of the most carefully safeguarded buildings on earth, special watchmen and mechanical protective systems being ever on guard.

Perhaps the most interesting work of the Treasury Department is the making of money, for which the department has two special branches—the Mint, for making coins, and the Bureau of Engraving and Printing, for making paper money, government securities, postage and revenue stamps, etc. (*see* Mint; Money). The Secret Service, another branch of the Treasury Department, has as its chief duty the guarding of the country's currency against counterfeiting.

The Treasury Department collects all taxes, including income taxes, levied by Congress for the support of the government; and it disburses all money collected according to Congressional appropriations, and prepares plans for the improvement of the revenue and the support of the public credit. The greater portion of the revenues of the government is collected by the Customs and Internal Revenue bureaus.

Of first importance to the business-like administration of the Federal government is the Budget Bureau, which was established as a branch of the Treasury Department in 1921. It is under the direction of a comptroller-general who is appointed for 15 years and is removable only by a joint resolution of Congress. Instead of sending its request for funds directly to Congress each department gives an itemized estimate of the amount of money needed annually to this bureau, where it will be submitted to expert analysis. This budget system does away with the old "pork barrel" which has cost the tax-payers of the country millions of dollars of wasted money, and secures to the various departments a steady income sufficiently removed from political manipulations to enable them to carry on their work uninterruptedly.

The Department's ordinary activities include also the supervision of the national banking system, comprising nearly 8,000 banks; the management of war risk insurance; the maintenance of a fleet of armed vessels ("revenue cutters") and a coast guard for the suppression of smuggling; the enforcement of the quarantine laws; the control of the Life Saving Service, the Public Health, and the Marine Hospital Service; the construction and maintenance of government buildings; and the audit and control of the accounts of the other executive departments of the government. The Treasury Department is under the direction of the secretary of the treasury, appointed by the president. He ranks second among the cabinet officers in line of succession to the presidency.

He is assisted by three assistant secretaries, and various other officials. These include the comptroller of the treasury, who constructs the laws relating to appropriations and methods of rendering and stating accounts, and countersigns all orders for the payment of money. He is the "watchdog of the Treasury," as no money can be paid out without his authorization. The treasurer of the United States, one of the officials of the department, is charged with the receipt and disbursement of all public moneys deposited in the Treasury and subtreasuries and national bank depositories. The comptroller of the currency has supervision of the national banks and their circulation and is ex officio a member of the Federal Reserve Board. Among other officers of the Treasury Department are the director of the Mint, the commissioner of internal revenue, the chief of the Bureau of Engraving and Printing, the chief of the Secret Service, and the head of the Public Health Service.

The Defense of the Country

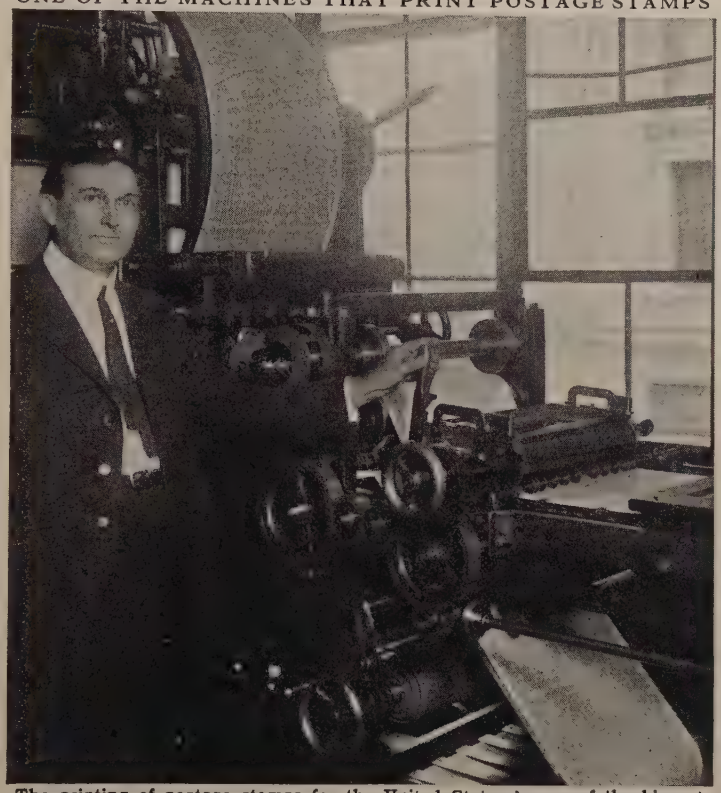
Two of the ten executive departments devote their activities to the defense of the country—the War Department and the Navy Department.

More men are employed in the War Department than in any other division of the government, but most of them are also army officers. The recruiting service of the army is a busy one even in times of peace, and the office of the adjutant-general keeps a full record of all men who enter the service. When Uncle Sam once secures these soldiers, the Quartermaster Corps must feed them and clothe them, the Ordnance Department supply them with guns, the Medical Department care for them when they are sick, and the department under the judge-advocate general try them when they are accused of criminal offenses. The General Staff makes plans for and directs all military operations and supervises the work of the Military Intelligence Bureau.

In times of peace the Board of Engineers for Rivers and Harbors is engaged in the improvement of the waterways of the country. The government of the island possessions of the United States—the Philippines and Porto Rico—is in the hands of the Bureau of Insular Affairs, which also has charge of the receivership of Santo Domingo. Other branches of the War Department are the Air Service, Chemical Warfare Service, Corps of Engineers, Signal Corps, Coast Artillery, Militia Bureau, and Panama Canal Office.

Though it takes longer to construct ironclads and build up an efficient navy than to recruit and train a good army, not so many men are required for the work of the Navy Department as for that of War. To it belongs the construction, armament, equipment, and use of the government vessels of war. It is organized under the secretary of the navy into divisions of Naval Operations (including Communication, Intelligence, and Aviation), Navigation (including the Naval Observatory in Washington), Yards and Docks, Ordnance, Steam Engineering, and Surgery. Its judge advocate general has general supervision of naval courts martial, courts of inquiry, etc. The Marine Corps is another important branch of this department, and in time of war the coast guard is placed under the Navy Department.

ONE OF THE MACHINES THAT PRINT POSTAGE STAMPS



The printing of postage stamps for the United States is one of the biggest printing jobs in the world. The stamps pour forth in a seemingly endless roll, twenty stamps wide. As fast as the stamps are printed they are gummed on the back, and cut into blocks of 10-square. Every sheet or block of 100 stamps is numbered, and must be accounted for at every stage of the process, just as if it were so much real money.

The Government in Business

The Postoffice Department conducts a gigantic business enterprise, carrying each year millions of letters and packages from one section of the country to another, conducting a savings bank with thousands of branches, and issuing money orders. The postmaster-general is the chief executive of this department, but he has four assistant postmasters-general to aid him in commanding the postal army. The department has also its own legal staff and its own force of traveling representatives or inspectors. The legal staff has charge of the enforcement of the laws against lottery schemes and swindlers and by excluding publications from the mails the department has powers of wide latitude.

Besides being in business itself, the government also aids individuals in business enterprises. The manufacturer, the merchant, and the consumer are all helped by the reports of the Department of Commerce. The Bureau of Standards in this department keeps the standard weights and measures and performs many useful functions. Your sugar brought from Cuba has been tested by this bureau; your electric light conforms to the standards established by it, and the scales used by your grocer owe their accuracy to the work of this bureau.

The Coast and Geodetic Survey under the Department of Commerce makes safe the coasts of the country for ships by issuing accurate charts showing depth of water, currents, etc. The Bureau of Lighthouses places warning beacons at all dangerous points.

The Department of Commerce also aids business through the Census Bureau. Not only is every man, woman, and child in the United States counted once

every ten years by the workers in this department, but statistics are collected concerning manufactures, agriculture, mines, and quarries, and once every five years the bureau makes an investigation of all manufacturing industries.

Departments for Farmers and Workers

No department of the government is more directly useful to the citizens than the Department of Agriculture, which aids the farmer as the Department of Commerce helps the manufacturer and business man. Through the Bureau of Animal Industry it studies animal diseases and methods of treatment, and undertakes experiments for the improvement of farm animals. The Bureau of Plant Industry finds and tests new plants and distributes rare seeds. The Bureau of Entomology can tell the farmer how to identify and destroy insect pests; the office of Farm Management how to organize the work of the farm; and the Bureau of Markets where to send his products in order to secure a good price. And finally he is warned of coming storms, frosts, and floods by its Weather Bureau, which studies the rainfall, temperature, and winds of the whole country by means of a widespread service, and forecasts the weather on the basis of these observations (*see* Weather Bureau).

Even the men employed in factory, mine, and office are not overlooked by Uncle Sam, for their interests are cared for by the Department of Labor. As the majority of newcomers to America are laborers, the Bureau of Immigration is placed in this department, and also the Bureau of Naturalization, which turns the alien into an American citizen. The welfare of children, both those who work and those who do not, is protected by the Children's Bureau, which investigates all matters pertaining to child life.

THE FILES OF THE PATENT OFFICE

There are 45 general divisions under which patents are filed, and hundreds of sub-classes or subjects. More have been taken out on transportation than on any other subject. Patent No. 1 was issued on July 31, 1790, and during the first century of its existence the Patent Office granted about 490,000 patents. In the next 30 years it issued nearly double that number, and today the rate is about 35,000 each year. Patent No. 1,000,000 was issued on August 8, 1911. The picture shows a part of the immense filing system.

The "Catch-All"

Apparently every duty that can be given to no other department is assigned to the Department of the Interior. Here we find grouped such unrelated bureaus as that of Pensions and the Geological Survey, of Patents and Indian Affairs. Originally it was intended that this department should have charge of all matters relating to the internal affairs of the country, but some problems—agriculture, commerce, and labor—grew so large that they needed departments of their own.

Today if you wish to obtain land from the government you apply to the General Land Office, Uncle Sam's real estate agent. The Reclamation Service, another bureau of the Interior Department, is busily engaged making some of this land usable by its huge irrigation projects in the arid West, and by its drainage canals in the marshes of Florida. If you wish information concerning the schools of the country you may apply to the Bureau of Education. Those wards of the government, the Indians, expect the Office of Indian Affairs to care for them. Pensions to the men who served in the army or navy of the United States before this country entered the World War in 1917, and to their widows, are granted by the Bureau of Pensions. And an inventor who wishes to secure exclusive patent rights to his new machine or information about other patents, must apply to the Patent Office.

The most ambitious project of the Interior Department is that of the Geological Survey, the making of a huge geological map of the United States. This map

will show when completed the beds of coal in the country, where deposits of potash for fertilizer are found, the location of phosphate beds, of petroleum supplies, in fact of all the great underground wealth of America. Every mountain, valley, stream, swamp, and building in the country will be shown on maps of the Survey, working in conjunction with the Geodetic Survey; but the work has been so carefully done that less than half of the country has been charted, after more than 30 years' labor. In the new Interior Department building in Washington, the Geological Survey has one of the largest and most complete color map-printing establishments in the country. The Bureau of Education is also under the Department of Interior. The Federal government conducts many schools for Indians, soldiers, sailors, army and navy officers' schools at West Point and Annapolis, but curiously enough the Bureau of Education has no relation to these. With a very meager appropriation its activities are chiefly in gathering statistics and making reports on various educational activities.

WHAT IS AMERICANISM?

Washington *defined it when he said: "This government, the offspring of our own choice, uninfluenced and unawed, adopted upon full investigation, completely free in its principles, in the distribution of its power, uniting security with energy, and containing within itself a provision for its own amendment, has a just claim to your confidence and your support. Respect for its authority, compliance with its laws, acquiescence in its measures, are duties enjoined by the fundamental maxims of true liberty."*

Jefferson *explained its meaning when he wrote into the Declaration of Independence: "We hold these truths to be self-evident—that all men are created equal; that they are endowed by their Creator with certain unalienable rights; that among these are life, liberty, and the pursuit of happiness. That to secure these rights, governments are instituted among men, deriving their just powers from the consent of the governed."*

Lincoln *gave his idea of it when he spoke of "a new nation conceived in liberty and dedicated to the proposition that all men are created equal," and again when he talked of a "government of the people, by the people, and for the people."*

Daniel Webster *expressed the same idea in these words: "I hold it to be a popular government, erected by the people; those who administer it responsible to the people; and itself capable of being amended and modified just as the people may choose it should be."*

Roosevelt *defined it when he said: "Our country—this great republic means nothing unless it means the triumph of a real democracy, the triumph of popular government, and in the long run, of an economic system under which each man shall be guaranteed the opportunity to show the best that there is in him."*

Wilson *said practically the same thing when he spoke of a "great free republic based upon traditions of personal liberty," and when he added: "Freedom today is something more than being let alone. The program of a government freedom in these days must be positive, not negative merely."*

A group of miscellaneous boards and commissions besides the ten departments perform important governmental work. The Government Printing Office prints tons and tons of reports on the work of the various branches of the government. The Civil Service Commission holds examinations for those wishing employment in government offices. The Interstate Commerce Commission regulates traffic between the states. And the Federal Reserve Board controls the credit of the country through its supervision of the Federal Reserve Banks. All these and others are necessary in the operation of the United States government.

Without the Department of Justice the laws of the United States would be practically dead letters. True, the Federal courts try those accused of breaking Federal laws, but these courts cannot act until someone has brought an accusation against the individual, nor can they collect the evidence on which the prosecution is based. All this work is done by the Department of Justice, in charge of the attorney-general. Its secret service investigates violations of the national banking laws, and customs and post-office frauds. It is the duty of this department also to prosecute all persons and corporations accused of violating the anti-trust laws.

Members of the Department of Justice also act as legal advisors to the other executive departments. The attorney-general and his chief assistant, the solicitor-general, prepare most of the opinions for the guidance of the president and the members of his Cabinet.

There is only one type of local government that comes under Federal control, and that is the government of that part of the national domain which has not been erected into states. This now consists of the District of Columbia, Alaska, and the insular possessions. The Constitution gives Congress the power to make all needful rules and regulations for the territories and other possessions of the United States. In recent years that body has conferred a large measure of self-government upon Alaska and the more important insular territories, and delegated to them much of the jurisdiction over purely local affairs. Alaska and Hawaii, the only two "territories" in the technical sense, are each allowed to send to the House of Representatives a delegate who may participate in the debates but has no vote. The chief executive officers are appointed by the president and paid from the national treasury. (*See also* such articles as Cabinet; Census; Congress of the United States; County; President of the United States; State Governments.)

THREE CENTURIES *of* AMERICAN HISTORY

The Story of the Great Republic — Founding and Growth of the Thirteen Colonies — Independence and Establishment of the Union — The Fiery Ordeal of Civil War — Rise to World Power and Influence

UNITED STATES HISTORY. The story of the United States is the story of the making of a nation, not of its birth full grown, with a government and territory supplied it as an easy heritage. Step by step government and national ideals have been shaped and modified and adjusted. Piece by piece territory has been added and exploration and settlement have pushed the frontier westward. Through conflict —domestic and foreign—and common purpose a national consciousness was created, and national ideals have found voice in the utterances of high-minded statesmen from the Revolution to the present day. It is the story of an experiment in self-government, with its roots in England but on a larger scale than has ever been known before in the world's history, and so broadly conceived that it has now the allegiance of adopted citizens from scores of different lands.

The story of the nation naturally falls into four parts. These are the colonial period (to 1783), the period of the formation and growth of the Union (1783–1829), the epoch of division over slavery and reunion (1829–1877), and the era of business expansion and world influence (1877 to the present). These periods overlap one another. The formation of the Union was begun while the colonies were still under the political control of England, and the seeds of the slavery contest go back of 1829, just as the expansion of the Union continues after that date. The United States was also, at least to a slight extent, mingling in world politics and laying the foundations for "big business" before the Union and the national spirit were fully secure

Sowing the Seed for a Hundred Years

One by one, over a period of more than a century, the 13 original colonies which formed the nucleus of the United States were settled. After several unsuccessful attempts directed by Gilbert and Raleigh (*see* Raleigh, Sir Walter) the English in 1607 founded their first permanent settlement at Jamestown, Va. (*see* Jamestown). In 1733 the last English colony, Georgia, was settled by James Oglethorpe, largely as a refuge for prisoners for debt. The others of the 13 colonies arose as follows: New York (1614), Massachusetts (1620), Maryland (1634), Connecticut (1635), Rhode Island (1636), Delaware (1638), North Carolina (1663), New Jersey (1665), South Carolina (1670), New Hampshire (1680), Pennsylvania (1682).

At first not all of these colonies were English. Delaware was settled by the Swedes, captured by the Dutch in 1655, and in 1664 taken by the English, when they captured also the Dutch province of New Netherlands, which they renamed New York.

Though the colonies were separated by wide stretches of wilderness, though they differed somewhat in government, in institutions, and in manner of life, movements toward union were made even before the last colony was settled. First the similar colonies of New England formed a confederation (1643) for defence against the Indians, French, and Dutch, which lasted until 1684. In the French and Indian Wars the colonists learned coöperation in their expeditions against Louisburg and Canada (*see* French and Indian War). During the same trying time Benjamin Franklin at the Albany Congress (1754) presented a plan for the union of all the colonies, a very wise project that came to no immediate results but indicated the drift of affairs.

Relieved of the danger of the French in 1763, the colonists next coöperated against the mother country. In 1765 the Stamp Act Congress met to protest against an obnoxious law (*see* Stamp Act). A similar meeting of protest was the First Continental Congress, in 1774; but the first real united work was that done by the Second Continental Congress, which began to direct the united revolt of the colonies in 1775. The Declaration of Independence in 1776 marks the beginning of separate existence, but it was two years later before the first of other countries—France—acknowledged America as a separate country; and even this act and the rebellion drove out large numbers of the timid and conservative who disagreed and remained Loyalists. After several years more of fighting (*see* Revolution, American), England herself in 1783 agreed to a peace which recognized that the 13 colonies were colonies no longer, and gave the new government all the territory east of the Mississippi which she had held—except Florida, which went to Spain.

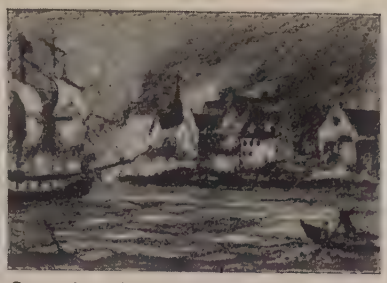
The Building of Nationality

Though the land no longer belonged to England, it could not yet be called a full-grown nation. The government had been somewhat strengthened by the Articles of Confederation—the first Constitution of the United States (drawn up in 1777, adopted 1781) —but only slowly was a national spirit created. The weakness of the government in this "Critical Period" of the nation's history—which allowed disunion to go so far as open rebellion (*see* Shays' Rebellion) —aroused the more far-seeing and sound-headed leaders like Washington, Hamilton, and Madison to the need of a new government and led finally to the adoption of the present Constitution.

But it is difficult to realize how poor and weak the country was in 1790, when the first census was taken. It owed $42,000,000 but numbered only 3,929,214 people. It was an almost wholly agricultural country. Although its farthest boundaries extended only to the Mississippi, the distances seemed immense, for there were neither railroads nor steamships, and this increased

DRAMATIC EPISODES IN AMERICAN HISTORY

July 30, 1619—The first legislative assembly in American history meets in the church at Jamestown.



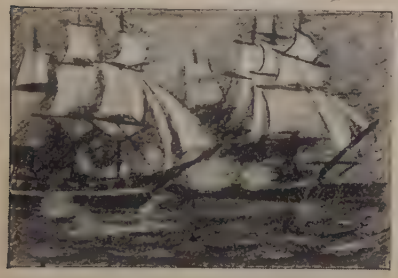
Sept. 20, 1776—Fire destroys a large part of New York City during British occupation.

July 4, 1776—The Second Continental Congress formally adopts the Declaration of Independence.

Aug. 6, 1776—Fifty-three members of Congress inscribe their names on the copy of the Declaration.

April 30, 1789—George Washington takes his inaugural oath on the balcony of Federal Hall, New York City.

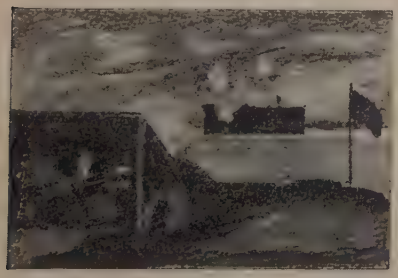
September, 1804—Lewis and Clark cross the Rocky Mountains on their expedition to the Pacific.



Sept. 10, 1813—Perry defeats the British on Lake Erie, and writes: "We have met the enemy and they are ours."

Dec. 2, 1823—In his message to Congress, President Monroe says to Europe: "Hands off America!"

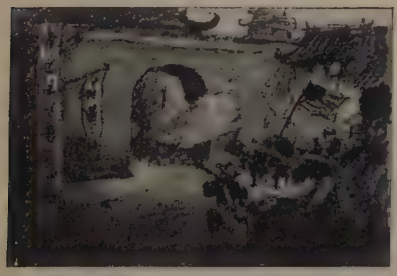
Sept. 13, 1847—American troops under General Scott storm Chapultepec and clear the way to Mexico City.



April 12, 1861—Confederates bombard Fort Sumter, which surrenders after two days. Civil War begins.

Mar. 30, 1870—The Fifteenth Amendment to the Constitution is adopted, giving suffrage to the negro.

July 1, 1898—American troops before Santiago, Cuba, storm and capture San Juan Hill and El Caney.



Aug. 15, 1900—Americans help capture Peking during Boxer Rebellion.

Aug. 15, 1914—The Panama Canal is opened to commercial traffic.

May 28, 1918—American soldiers "go over the top" at Cantigny, France.

contained in the Easy Reference Fact-Index at the end of this work

the labor of governing from a single center. The states were jealous of one another and of the Union. The things that saved the nation were the men who set the Constitution in operation and created under it a strong government; the keen and intelligent interest of its citizens in politics; and the joint possession and settlement of the new domain in the west, where the states had yielded their claims beyond the Alleghenies to the Union. Free navigation of the Mississippi was secured from Spain (1795), and emigration began to flow freely across the mountains.

Washington, who stood above parties, gave his influence for a stronger union, and his name and fame were a rallying point for the new central government. But to the Federalist party, which believed in a strong central government, belongs much credit, to Alexander Hamilton in Washington's cabinet, and to 30 years of broad interpretation of the Constitution by John Marshall at the head of the Supreme Court. Under the Federalists the first United States bank was established (1791), the debts of the states were assumed as a part of the national debt, protection of American manufactures was begun, and internal revenue taxes were laid (*see* Hamilton, Alexander). When these last provoked the "Whiskey Rebellion" in western Pennsylvania (1794), Washington marched troops into the district and proved that national laws were to be obeyed.

But still the people of the United States did not feel as a nation. The British had been so confident of this that they had held the forts of the Northwest until Jay's treaty was ratified in 1795. The Virginia and Kentucky Resolutions, provoked by the Alien and Sedition Laws passed to curb French partisans, laid down the doctrine of states' rights almost as a threat, (*see* Adams, John).

So violent was the opposition to the excesses of the Federalists that the control of the government passed into the hands of the party of Jefferson—then called "Democratic-Republicans." But though this party in theory believed in the supremacy of the states, in practice the nation grew under their hands both in territory and in spirit and President Jefferson gave to democracy a new and broad interpretation. In 1803 the vast stretch of territory known as Louisiana was purchased from France (*see* Louisiana Purchase) and Florida was secured from Spain in 1819. National honor was upheld in a war with the Tripoli pirates (1801–05). The invention of the steamboat by Robert Fulton (1807) made transportation easier, and a vast scheme of "internal improvements"—highways and canals—by the national government was planned to bind the states more closely together. Finally the War of 1812 hardened the gristle of the young nation into bone. National pride gloried in the naval victories over England, the mistress of the seas, and forgot the blunders on land. The Federalists of New England, who opposed the war and called the "Hartford Convention" which recommended drastic constitutional amendments to protect their sectional interests (December 1814), were scorned by their fellow-citizens, as plotters of treason, and Jackson's victory at New Orleans and the signing of peace at Ghent completed their downfall. The close of the war saw the country with infant industries to protect and a self-consciousness that began to shape a national foreign policy in the Monroe Doctrine.

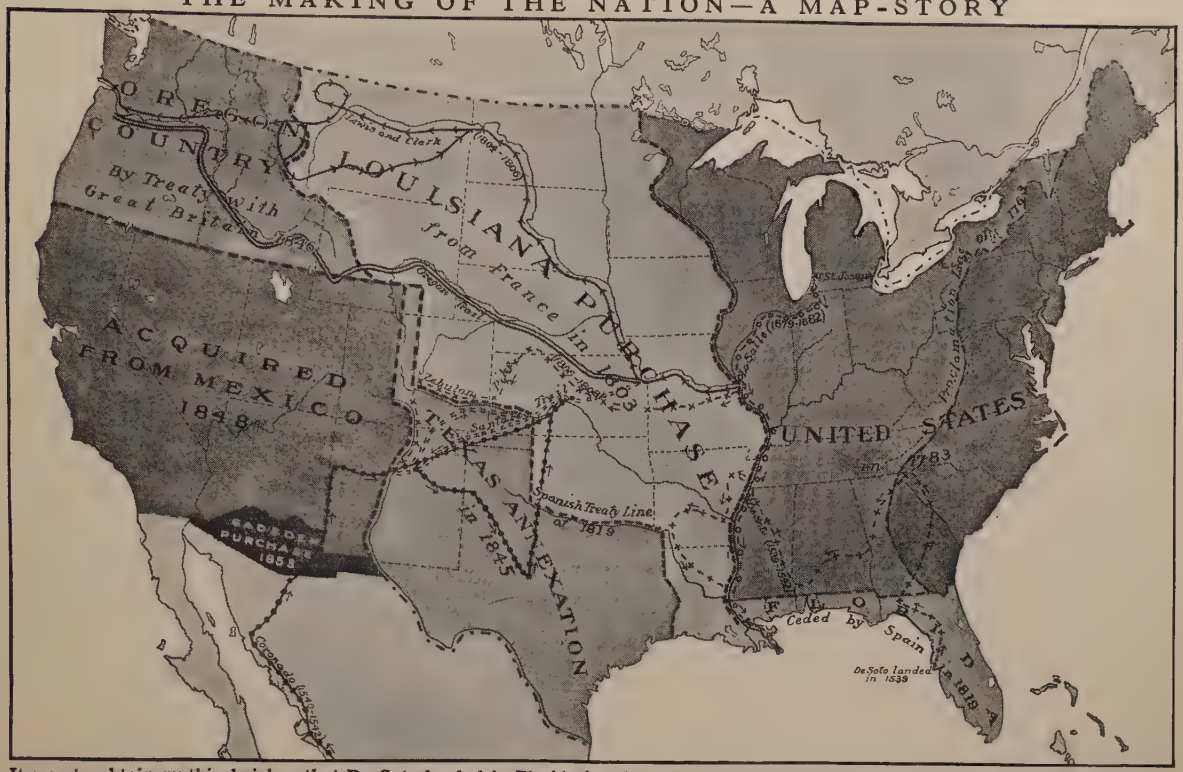
All this time a new force was modifying the course of American history. This was the West. Five states west of the Alleghenies had been admitted to the Union by 1820—Kentucky (1792), Tennessee (1796), Indiana (1816), Illinois (1818), and Missouri (1820). The dominating feeling in these regions was the individualism and democracy of the pioneers, a striking combination of the idea of self-help and of willingness to coöperate in emergencies. And when their representative, Andrew Jackson, gained the presidency in 1829, he was the very embodiment of this newer, cruder, forceful western democracy. He destroyed the national bank and he stopped all internal improvements by government aid (*see* Jackson, Andrew). On the other hand he took a firm stand when South Carolina attempted to nullify the tariff of 1833, and by sending troops into that state forced her to allow national laws to be enforced.

The Slavery Question Divides the Sections

The new political parties—Democrats and Whigs—which arose with Andrew Jackson were at one in favoring territorial expansion, however they might differ as to details, and under their alternating sway the territory of the United States soon reached the Pacific. Texas, after winning its independence from Mexico, was admitted to the Union in 1845. A war over boundaries followed with Mexico (1846–48), which added the territory now included in the states of California, Nevada, Utah, and most of New Mexico and Arizona. A treaty with Great Britain ended the joint occupation of the Pacific Northwest, which had lasted since 1818, and gave the Oregon country up to the 49th parallel to the United States (1846). Finally the "Gadsden Purchase," in 1853, added a strip of 45,535 square miles south of the Gila River, in southern Arizona and New Mexico, bought from Mexico for $10,000,000.

This gain in territory did not prove an unmixed blessing, for it was accompanied by the rise into new importance of the question of slavery. For over 30 years this question between the North and the South overshadowed every other political issue; it aroused sectional jealousies to the highest pitch and almost wrecked the nation. Differences deeper than states' rights or even slavery had been separating the sections. The South with its plantations and agricultural life had preserved the conditions and attitudes of the early days, while the North with a developing industry and manufactures and transportation was carried on into advocacy of free labor, government support by tariffs, national roads, and in general into a more complex life and an expanding view of the place and power of the national government.

THE MAKING OF THE NATION—A MAP-STORY



It was to obtain mythical riches that De Soto landed in Florida in 1539. Two years later he discovered, not gold, but the sluggish Mississippi which was to be his grave. Another myth lured Coronado, in 1540, on a terrible journey to find the Seven Cities of Cibola. He found mud pueblos and hungry Indians. A century later La Salle, guided by Indian tales, reached the mouth of the "Father of Waters," where he planted the Lilies of France. In 1783, the United States was bounded on the west by the Mississippi; in 1803, the Louisiana Purchase brought it to the Rockies. Lewis and Clark, sent out to explore the new region, reached the Pacific, 1804–06. A similar expedition, led by Zebulon Pike, explored the southwest, 1806–07. Soon eager traders and men dreaming of an empire were pressing westward over the famous Santa Fe and Oregon trails. The annexation of Texas added 400,000 square miles in 1845. The acquisition of the Oregon territory in 1846 and the southwest after the Mexican War carried it to the Pacific. Florida, bought from Spain in 1819, had rounded out the southern coastline, and the Gadsden Purchase on the Mexican border in 1853 brought the United States to its present limits—its "manifest destiny" had been fulfilled.

During these years of political strife within the nation men tried to settle the slavery question by the Compromise of 1850, the Kansas-Nebraska bill (1854), and the Dred Scott Decision (*see* articles under these headings). But all proved in vain and in 1861–65 the quarrel was fought out on the battlefield (*see* Civil War and Reconstruction).

A still more crucial test of the stability of the American form of government came in the period of reconstruction after the war. Deprived of the leadership of the wise and forgiving Lincoln, the direction of affairs was taken over by certain irreconcilable congressmen whose chief idea was to punish the South. There was a prolonged and bitter quarrel between President Johnson and Congress (*see* Johnson, Andrew), but Congress in the main had its way. The 13th Amendment to the Constitution (1865) prohibited slavery, and the 14th and 15th amendments (1868 and 1870) protected the former slaves and gave them the ballot. The ex-Confederates were disfranchised and excluded from holding office. Thus the government in most of the Southern states fell for a time into the hands of ignorant former slaves and designing Northern "carpet-baggers." Not until February 1871 did all the Southern states again have representatives in Congress. Next year full civil rights were restored, and immediately after Rutherford B. Hayes became president, in 1877, he withdrew the Federal troops from the South. The last remnants of the "carpet-bag" government of the Southern states by the negroes and Northern office-holders then ceased. National elections soon ceased to be confused by dead issues growing out of the Civil War. The United States was indeed a nation.

Business Expansion and World Influence

The years between the period of Reconstruction and today belong to recent American history. The three great phases of the time are (1) the disappearance of the frontier and of abundant free land, (2) an enormous economic and industrial growth, and (3) the participation of America in world policies.

The interest of the country for a long time centered in domestic questions relating to business. Tariff laws were passed giving increased protection (*see* Tariff). Even more important were "currency" matters, or questions relating to money. The Supreme Court had declared that the "greenback" paper money issued to carry on the war was legal tender for all

domestic debts. As a result gold rose to a high premium, and on "Black Friday" (Sept. 24, 1869) a panic was caused in financial circles when Wall Street bankers attempted to "corner" the gold supply and forced the price of a gold dollar to $1.63 in greenbacks. Even more disastrous was the widespread panic which broke out on Friday, Sept. 19, 1873, following the "demonetization of silver." "Specie payments," or the exchange by the Treasury of gold or silver for paper currency, dollar for dollar, had been suspended since 1861; and it was not until Jan. 1, 1879, that specie payments were at last resumed. In 1896 the currency question again came to the front, and the chief question in the election was whether the United States should adopt gold alone as its monetary standard, or restore the "free and unlimited coinage" of silver, repealed in 1873. In 1900 gold was by law made the standard currency. Business about this time increased by leaps and bounds. Corporations and trusts were formed and had to be dealt with (*see* Trusts). Even in the South great industrial centers, like Birmingham, Ala., grew up to break the uniformity of cotton and tobacco-growing.

At the same time the United States was drawn into world affairs. In 1867 she had, by the purchase of Alaska, acquired territory separated from the rest of the states. In that same year she proved her leadership in the Western Hemisphere, under the Monroe Doctrine of 1819 (*see* Monroe Doctrine), when she compelled France to withdraw from Mexico, thus enabling that country to overthrow the "Emperor" Maximilian (*see* Mexico). While Benjamin Harrison was president (1889–93) a revolution occurred in Hawaii, the native monarchy was overthrown, and the new government applied for annexation to the United States. A treaty was negotiated granting this and was awaiting ratification by the Senate when President Cleveland began his second term (1893); he withdrew the treaty from the Senate on the ground that American naval forces had improperly aided the revolution. In McKinley's administration, however, the treaty was ratified and the islands finally became a part of the United States (1898).

Increasing Influence in World Politics

In other ways the year 1898 marked a definite advance of the United States into world politics. At that time she engaged in war with Spain (*see* Spanish-American War), as a result of which she gained Porto Rico and the Philippines and freed Cuba. Through her influence in Cuban affairs, as well as the later purchase of the Danish possessions in the Virgin Islands (1917) and the building of the Panama Canal (1904–14), the United States further developed her interest in the Caribbean Sea. In 1900 the United States joined the powers of Europe in suppressing the Boxer rebellion in China.

The seven years of Roosevelt's presidency (1901–09) were marked by the frequent participation of the nation in world politics. The Canal Zone was acquired and the Panama Canal begun (*see* Panama Canal). The republic in Cuba was strengthened. Financial control of Santo Domingo was assumed (*see* Santo Domingo). A powerful fleet was sent on a trip round the world, and the President's mediation ended the Russo-Japanese War. The United States participated in the second Hague Peace Conference (1907), as it had already done in the first (1899). In 1908 an agreement was entered into with other nations for the maintenance of the national integrity and an "open door" in China.

The affairs of the United States had become inextricably mingled with the affairs of other nations. This was proved when President Wilson struggled in vain (1914–17) to keep the country out of the World War (*see* World War of 1914–18). When at last, in April 1917, she was forced into the struggle, it was but natural that she should be looked to by all nations, large and small, for leadership in the realization of the idealism which had inspired her past policy. (For additional information, *see* the special articles mentioned above, and also the several presidential administrations, each of which is treated under the name of the president.)

UNIVERSITIES. Although there were schools of rhetoric and philosophy in ancient Greece and Rome, and Mohammedanism developed its great schools for religious teaching in Egypt, Turkey, and Asia, it was chiefly from institutions fostered by the Christian Church in medieval Europe that the universities of today take their origin. In Germany and elsewhere in Europe the word "university" ordinarily means an institution of advanced rank where students of mature age follow courses in law, medicine, theology, philosophy, and the like. In the United States there is no sharp line between the "college" for general cultural studies, and the "university" for post-graduate work and professional courses in law, medicine, and other subjects. In general a university is a larger and more advanced institution than a college; but usually an American university also includes in its organization a division (called the "College of Liberal Arts," or some similar name) which gives undergraduate work in the cultural subjects, the same as the ordinary college.

It does not make so much difference, however, what the name is by which an institution is called. The important thing is the number and fitness of its teachers, and the extent and quality of its libraries, laboratories, and other facilities for teaching. (*See* Colleges and Universities.)

URAL MOUNTAINS. There are no towering peaks in the Urals—the longest mountain chain in Europe. In a country less flat than Russia they would hardly be called "mountains"; yet they have for ages formed a large part of the boundary between Europe and Asia, dividing Russia and Siberia. The Urals are for the most part a series of table-lands, extending like a huge caterpillar in a nearly north and south direction from the Arctic Circle almost to the Caspian Sea, a distance of about 1,500 miles. The peaks

stand like "isolated tents," rarely above 5,000 feet high, and averaging less than 1,500.

As far back as the 9th century the Urals were known among the Greeks for their great mineral wealth. They contain almost every rock and metal that men prize as rare and beautiful. They supply 95 per cent of the world's platinum; they are rich in gold, iridium, and copper; and silver, mercury, zinc, and numerous other ores, in addition to iron and coal, are found in large quantities. Add to this their list of precious stones—sapphires, emeralds, beryls, topaz, amethysts, and many others—and an account of the Ural products reads like a tale from the 'Arabian Nights'.

For the greater part the plateaus and ridges are covered with forests, spreading out to a width of nearly 200 miles; but in the north the chain appears only as a narrow treeless ridge, and in the south it divides into a western and southern outrunner, the latter called the Mugodzhar Mountains.

URANUS. Far back in the beginning of things, so the imaginative Greeks believed, there was no sky and no earth, no men and no gods. All was chaos—immeasurable empty space. But gradually things began to take form. First appeared Sky and Earth, whom the Greeks called Uranus and Gaea.

Sky, the first ruler of the world, took Earth to wife, and they had many children. Among them were 12 huge Titans, three terrible brothers called "Cyclops" who had only one eye apiece, and three giant "Hundred-handers"—Briareus and his two brothers, with their hundred hands and fifty heads. Now the hideous Cyclops and Hundred-handers were hateful to their father, as they well might be, so he thrust them into Tartarus, the vast abyss below the earth. But indignant Mother Earth called on the Titans to rise against their father, and Kronos, craftiest of them all, made himself ruler in his father's stead.

The new lord of heaven and earth then married his Titan sister Rhea, and she bore him six children—the six chief divinities of the Greek mythology: Zeus, Hades, Poseidon, Hera, Hestia, and Demeter. Hearing that one of his children would dethrone him, as he had dethroned his father, Kronos swallowed each of them at birth, except the last, Zeus (Jupiter). Him Rhea saved by giving Kronos a stone wrapped in swaddling clothes instead of the child. When Zeus grew up, he forced his father to disgorge unharmed the children he had swallowed. With his brothers and sisters he overthrew Kronos and the other Titans, and himself became ruler of the universe. In later times Kronos was identified by the Romans with their god Saturn (*see* Saturn).

In astronomy Uranus is the seventh planet in the order of distance from the sun. It was discovered by the elder Herschel in 1781. Uranus has four satellites or moons revolving about it. (*See* Astronomy; Planets.)

URBAN, POPES. Of the eight popes who have borne this name, URBAN I (pope 222–230) belongs to the period before the official toleration of Christianity by the Roman Empire.

URBAN II (pope 1088–1099) was a monk of Cluny, in France, and was called to Rome by the great Gregory VII, whom he followed in the papal chair after a three years' interval. He too was a great reforming pope, attacking simony, lay investiture, and clerical marriage; but he is chiefly remembered because of his part in calling the First Crusade (*see* Crusades).

URBAN III (1185–1187), and URBAN IV (1261–1264) need only passing mention. URBAN V (pope 1362–1370) was a French pope during the period known as the Babylonian captivity. In 1367 he resolved to return the seat of the papacy from Avignon (on the River Rhone) to Rome; but he found Rome in such a ruined condition as the result of more than 60 years' absence of the popes that he returned to Avignon, where he soon died.

URBAN VI (pope 1378–1389) succeeded Gregory XI, who also had brought the papacy back to Rome and died there. Urban was elected pope while a Roman mob was howling about the place of conclave, threatening the cardinals if they did not give them "a Roman or at least an Italian pope." Cardinals who disliked the harshness of character which Urban unexpectedly showed seized upon this pretext to declare the election invalid and elect an anti-pope, Clement VII, who set up his court at Avignon. Thus began the Great Schism (1378–1417), in which half of western Europe adhered to Urban and his successors at Rome, and the other half to Clement VII and his successors at Avignon.

URBAN VII (pope 1590) died 12 days after his election and was never consecrated. URBAN VIII (pope 1623–1644) was on the whole vigorous and enlightened. To him Rome was indebted for many public works. He founded the College of the Propaganda.

UR'UGUAY. A fertile and well-watered soil, a beautifully temperate and equable climate, and an exceptionally fortunate geographical position combine to make this, the smallest of the South American republics, a land of great possibilities. Its general outline is almost square, with a seaboard of 120 miles on the Atlantic, 235 miles on the Rio de la Plata, and 270 miles along the eastern bank of the Uruguay River. The northern frontier with Brazil, running diagonally from northwest to southeast, is about 450 miles long. Its total area is about 72,200 square miles, about 5,000 less than that of Nebraska. The population is estimated to be about 1,460,000, giving it an average density of population of about 19 to the square mile as against 15 to the square mile for Nebraska, which is considerably greater than that of any other South American state.

Uruguay is also marked out from its sister states in that it has no stretches of rugged barren mountain territory such as are found in the republics of the Andes, no tangles of jungle and swamp such as Brazil has, no desert tracts like southern Argentina, and no flat monotonous pampas like central Argentina. Aside from its sandy coast and a few barren hilltops,

there is scarcely an acre of useless ground. The southern and eastern half of its surface is gently undulating grassland, with a few stretches of valuable timber. To the north and west rise swelling downs intersected here and there by low ranges of hills with fertile valleys. A network of about 500 rivers and streams gives it abundant water except in unusually dry seasons.

The climate, tempered by the Atlantic breezes, is one of the most delightful and healthful in the world. Frosts occur only on the uplands of the interior, and the midsummer temperature rarely exceeds 86 degrees except near the subtropical region bordering on Brazil. Such sudden and trying variations of temperature as occur at Buenos Aires, on the southern bank of the Plata, are rarely known at Montevideo, the Uruguayan capital (*see* Montevideo). The sunny blue skies, fresh sea breezes, and balmy temperature in winter and summer alike make that beautiful city a favorite resort for wealthy Brazilians and Argentineans. The fact that it has one of the lowest death-rates in the world shows the healthfulness of the republic.

Abundant crops of wheat, linseed, oats, barley, corn, tobacco, and grapes can be grown on its rich soil. Uruguayan or "Montevideo" wheat is nowhere surpassed, and it is quoted at the highest prices in the markets of Europe. But so far the development has been chiefly pastoral. Only about 10 per cent of the land is under cultivation, but Uruguay has more cattle and sheep per capita than any other nation in the world. The chief drawback to agriculture is the periodical droughts, which recur every six or eight years.

Hides, salted or "jerked" beef, wool, and other stock-raising products furnish 90 to 95 per cent of the nation's exports. It has one of the largest beef-extract factories in the world. But the country seems destined to remain a land of farms and ranches rather than of manufactures, because of its lack of extensive coal deposits. There are gold mines, and silver, copper, iron, and manganese occur to a limited extent. A large proportion of the inland trade is carried on in boats of light draft, the Uruguay being navigable for about 200 miles and the Rio Negro and other streams for shorter distances. More than 1,700 miles of railway have been built, chiefly with British capital.

The Indian, negro, and *mestizo* or half-breed elements are smaller factors in the population than in most of the neighbor states. Ninety per cent of the population are of European descent, chiefly Spanish and Italian. The largest early immigration came from the Canary Islands, where the people were descendants of the Spaniards and the native Guanchos, with mingled Norman, Flemish, and Moorish blood. The present rate of immigration is low, and 70 per cent of the population are of native birth. Education, though better than in most of Latin America, is backward, and about half the people are illiterate. Primary instruction is free and compulsory. There are fewer large fortunes, and on the other hand less poverty, than in most other Latin-American states.

Uruguay has been hampered in its development by warfare, by intrigues, and by political crimes. The Uruguayans fought first against Spain to gain their freedom, issuing their declaration of independence in 1825, then against the Portuguese rulers of Brazil. From 1843 to 1852 Uruguay fought for its life against the aggressions of Argentina; and between 1865 and 1870 it was the ally of Brazil and Argentina in a war against Paraguay. Acute political divisions have existed ever since Generals Oribe and Rivera strove for the mastery three-quarters of a century ago. Because General Oribe rode a white

URUGUAY AND PARAGUAY

One of Uruguay's chief assets is its position on that great gateway of commerce, the Plata River. Paraguay and its neighbor, Bolivia, are the only South American states completely cut off from the sea.

horse and his followers carried white banners, while General Rivera's horse was bay and his banners red, the Uruguayans have ever since been divided into *Blancos* and *Colorados* (Whites and Reds), and revolutions and assassinations have been frequent. As Clemenceau, the great French statesman, said, "When a boy is born in Uruguay he is given a white or a red ribbon, which he is enjoined to defend and hand down to his children." Generally speaking, the *Blancos* are the Conservatives and the *Colorados*, who have been in power for the past 50 years, are the Radicals. The result of this incessant political warfare has been to hamper the country's social and economic development, so that Uruguay has been called "one of the worst governed of civilized nations."

Uruguay is a centralized republic, in which the central executive has direct control of the 19 departments or provinces. Each department has a governor appointed by the executive, and a council elected by popular vote. The executive power is wielded by the president and a National Administrative Council, each selected by direct popular vote. The general assembly consists of two chambers—senate and house of deputies. There is no state religion, but the population is predominantly Roman Catholic.

Although Uruguay received no direct injury from Germany during the World War, it severed diplomatic relations on Oct. 7, 1917. Eight German ships in Uruguayan harbors were seized and leased to the Emergency Fleet Corporation of the United States.

A Fertile Utah Valley in the Shadow of Snow-Clad Peaks

UTAH. The "Salt Lake State" not only contains the most mysterious body of water in the New World, but has many other sources of never-ending interest and wonder. Mountains which shut out the moisture-bearing winds but accumulate melting snow on their crowns and sides are piled up to a height of from 10,000 to 13,500 feet; and mighty rivers pouring through countless canyons send cataracts and cascades leaping and foaming down a thousand dizzy precipiced channels. With an area as large as all New England combined with Maryland and Delaware, Utah has room for parks larger than whole eastern states, in which nature has built mammoth stone bridges and huge statues of unnamed monsters—master works worthy to be classed with the wonders of the world. There are irrigated valleys with orchards and gardens, vineyards and grainfields, as well as burning, cactus-covered deserts; and the whole great state is underlaid with gold and silver, coal, lead and copper, and nearly every other metal and mineral in human use.

Extent—North to south, 345 miles; east to west, 280 miles. Area, 84,990 square miles (of which nearly 3,000 are water). Population (1920 census), 449,396.
Physical Features—Wasatch Mountains stretching south from the northern boundary; Colorado plateau to the east crossed by Uinta and lesser mountain ranges (Mt. Gilbert and Mt. Emmons, nearly 13,500 feet), to the west the Great Basin containing the Great Salt Lake and the Salt Lake desert. Principal rivers: Bear, Weber, and Jordan flowing into the Great Salt Lake; Sevier emptying into Lake Sevier; Colorado and its tributaries, the Green, Grand, and San Juan.
Products—Hay, wheat, oats, potatoes, sugar beets, fruits and vegetables; sheep and wool, cattle and dairy products, horses; copper, coal, silver, lead, gold, salt; flour, beet sugar, canned goods, etc.
Chief Cities—Salt Lake City (capital, 120,000), Ogden (33,000), Provo (11,000).

The men whom conquest of gold lured into Utah's desert never dreamed what its barren lands could

contained in the Easy Reference Fact-Index at the end of this work

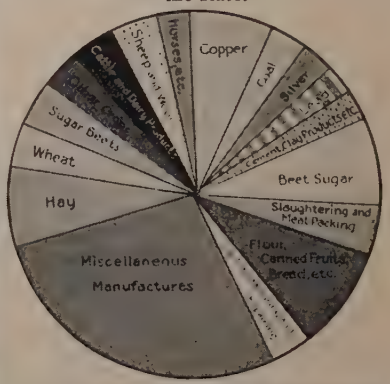
produce. Where no water is, the soil presents a desolate picture of greasewood and cactus as in the Valley of Death, where neither beast nor bird can live, and where in 1850 a train of 87 immigrant families perished. Turn on the water, and a garden blooms. The soils are among the most productive in the United States, made rich by thick deposits of an ancient sea (Lake Bonneville), which in the glacier period covered the western half of the state. Brigham Young, who in 1847 led his little band of Mormon followers to the Utah valley, saw the possibilities of agriculture. "We cannot eat gold and silver," he told the people, and urged them to devote themselves to farming. To these early settlers we owe the first irrigation canals of the United States. Wherever a stream flashed into the sunshine from the gloomy mountain gorges it was caught and trailed into a thousand little rills upon the thirsty land. Since that time many millions of dollars have been spent for collecting the water in great reservoirs and distributing it scientifically wherever and whenever it is needed. At enormous expense the Strawberry River, which flowed east into the Green River and thence into the Gulf of California, was caught in a great reservoir and made to flow west through tunnels in the Wasatch Mountains. The completing of this project in 1916 made many thousand additional acres of the valley fruitful.

Only about one-tenth of Utah is under cultivation, but many fruits, flowers, and vegetables are grown in large quantities from small areas. In the extreme north the hardier grains, vegetables, and fruits are raised, and in the south cotton, almonds, figs, walnuts, pomegranates, and grapes are grown to some extent. Between these two are all the crops common to the temperate zone, the most important being wheat, oats, potatoes, hay, sugar beets, and fruit. On all of its irrigated land Utah ranks high in the yield per acre. Grasses and grains are also raised on "dry" farms where the annual rainfall is 12 inches or more, and grazing is carried on in unirrigated sections.

But the great industry of Utah thus far has been its mining. Every mountain range is a hiding place for mineral treasures, from gold to lead and coal to zinc. At Bingham, near Salt Lake City, is one of the greatest and strangest copper-producing camps of the world, where thousands of tons of ore are yielded each day without shaft or tunnel or any underground work. From a mountain of copper ore four miles around the

THE RUGGED STATE OF UTAH

The map shows Utah's great mountain backbone, splitting the state in two. Below we see the relative value of Utah's products, also how tremendously the Mormon church predominates in the state.



For any subject not found in its alphabetical place see information

VARIED ASPECTS OF UTAH'S WONDERLAND

The Basis of Utah's Riches—Her Many Minerals
Vast Salt Beds
What Irrigation Does
Important Sugar Beet Yield
The Capitol, Salt Lake City
A Natural Wonder
University of Utah, Salt Lake City
They Can't Help Floating

At the top is the famous Bingham mine, exploiting a vast deposit of copper. The metal is contained in low-grade porphyry ores, which are scooped up by steam shovels. Utah also possesses rich beds of salt, worked with plows and scoops. Irrigation makes the former desert yield a variety of crops, among which sugar beets occupy a prominent place. For those seeking pleasure, Utah has many attractions to offer—wonderful scenery, typified by the "Great Guard" rock in Weber Canyon, and the marvelous Salt Lake with waters so dense that bathers float easily on its surface. The Capitol and the University building are typical of the fine architecture which marks the public edifices of the state.

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base and nearly 2,000 feet in height gigantic steam shovels tear out the ore and dump it into cars that take it to the crushing mills and smelters. Second to copper in value is the output of coal, followed by silver and lead. The apparently inexhaustible supplies of iron ore in the southern part have been little worked so far because of their inaccessibility, but salt, limestone, marble, and many other mine and quarry products are obtained.

How the Mormon Church Has Helped

In the development of the state's resources, especially in irrigation projects and in great retail stores, the organization of the Mormon church has pursued a very enlightened and far-sighted policy of encouraging coöperative enterprises. Nowhere has the energy and thrift of a whole state population been more consciously and effectively directed to the development of natural resources. Mormons themselves jokingly tell the story of the surprise of the visitor to the infernal regions who found them green and blossoming. Satan disconsolately explained that it used to be just what the visitor expected but that some Mormons had come down and at once started an irrigation project and this was the result.

In the same latitude as Virginia, Utah enjoys one of the finest climates in the country. The temperature varies considerably with altitude, and if the valleys are warm, one can always get a snowball by climbing a few miles up a mountain-side. The marvelous commingling of salt-sea and mountain air, with its highness and dryness, make the state one of the world's great natural sanitariums. There is no sea bathing anywhere which equals that of Great Salt Lake, where the water is so buoyant that it is impossible to sink in it (*see* Great Salt Lake).

Utah's Chief Cities

Salt Lake City, the capital, is the largest and most beautiful city in the state. The great Tabernacle and the Mormon Temple, the capitol, and the state university are the most striking buildings (*see* Salt Lake City). Ogden, visited by many tourists because of the picturesque Ogden Canyon at the city limits, is a large manufacturing city, containing woolen mills, beet sugar and canning factories, cereal establishments, and other industries. Provo is in the center of the agricultural area.

Spanish agents sent by Coronado first touched this area in 1540 and it was penetrated by occasional missionaries and travelers in the next two centuries. In 1824 James Bridger, a hunter, discovered Great Salt Lake. The territory included in Utah was part of the territory acquired by the United States in 1848 at the close of the Mexican War. The Mormons under Brigham Young had settled here in 1847. The growth of the state's population at first was confined to Mormon converts. They organized it as the State of Deseret but the United States refused admission and set up the territory of Utah in 1850. Long controversies followed between the Mormons and the government officers. The influx of gentile (non-Mormon) settlers after the Civil War and the question of polygamy were long subjects of controversy and the latter practice delayed the admission of Utah as a state. Federal legislation against polygamy was ineffective and the friction was so great that garrisons of Federal troops were sent in from time to time. In 1890 the president of the Mormon Church issued a statement that it no longer approved polygamy. In November 1895, a constitution was adopted and the state was admitted to the Union in January 1896.

UTRECHT (*ü'trĕkt*), NETHERLANDS. This quaint old Dutch city, famous for its historic memories, has stood for many centuries at the point where the Rhine River divides into two branches, the one known as the Old Rhine, and the other as the Vecht. The Romans called it *Trajectum ad Rhenum*, or "ford of the Rhine," and its present name *Oude Trecht* or Utrecht means "old ford." Here St. Willibrod, the English apostle to the Frisians, founded a bishopric about 700 A.D., about which the city grew. In 1579 the seven northern provinces of the Spanish Netherlands—the future Dutch republic—joined in the Union of Utrecht to make good their revolt against the political and religious tyranny of Spain; and here in 1713 was signed the famous Treaty of Utrecht, which terminated the War of the Spanish Succession and gave the southern Netherlands (Belgium) to Austria, and Nova Scotia, Newfoundland, and Gibraltar to Great Britain.

In the center of the town stands the old "Dom" or cathedral, begun in the 13th century, which occupies the site of the church formed by St. Willibrod. This was one of the finest and largest churches in Holland, but in 1674 a hurricane blew down the nave, and it was never rebuilt, so today an open space separates the solitary western tower from the choir and transept. From the tower, with its chime of 42 bells, one gets a good view of the broad green pastures dotted with herds of black and white cattle, and of almost the whole of Holland, including Amsterdam, 22 miles to the northwest. Graceful Gothic cloisters connect the cathedral with the University, one of the most famous in the Netherlands. Among other buildings of historic interest is the "Pope's house," built in 1517 by the future Pope Adrian VI, the only man of Dutch birth to hold this office.

Utrecht is traversed by two canals, spanned by over 90 bridges. The roadways lie high above the surface of the canals, which are reached by steps, and many of the poorer people live in cellars beneath the roadways with their doors opening on the canals. The old ramparts have been converted into pleasant promenades, bounded by water courses. On the east side of the city is the famous Malieban, a triple boulevard, shaded by lime trees and flanked by handsome houses. Good water communications and railways make Utrecht an important center of trade, and there are manufactures of woolens, silk, velvet, carpets, carriages, organs, cigars, chemicals, machinery, etc. Population, about 140,000.

V

VACCINATION. One summer afternoon in the year 1768 a young milkmaid came for advice to a small hospital in Berkeley, a town in Gloucestershire, England. The physician in charge spoke of smallpox, which in those days was among the most dreaded of diseases. "Oh," said the milkmaid, "I cannot take that disease, for I have had cowpox."

This remark merely expressed the common belief among the country people of the neighborhood, and it passed unnoticed by all except a young medical student named Edward Jenner, who was getting his first training in surgery. His alert mind seized upon the idea suggested by the milkmaid, and it occupied his attention constantly while he was completing his medical education in London. He returned to practice in his native village in 1773, and for the next 20 years devoted his spare time to investigation. He found that what the milkmaid had said was true. Those who had had cowpox, which is a mild disease in human beings, very rarely caught smallpox.

Why not, thought Dr. Jenner, find a way to give people a light attack of cowpox and so safeguard them from the horrible plague of smallpox? In 1796 he made his first experiments. He took from the skin of persons suffering from cowpox small quantities of pus, with which he inoculated several children. From the sores which developed on these first patients, he inoculated others. In 1798 he made his first great test. Four children who had undergone inoculation with cowpox were inoculated with smallpox. Not one caught the disease. So Jenner had made the great discovery of vaccination, which today has almost wiped out one of the most deadly of diseases.

MAKING TYPHOID VACCINE FOR THE ARMY

Typhoid fever has been virtually stamped out of the United States army and navy by the use of typhoid vaccine, which is prepared in immense quantities in the Army Medical School at Washington. Cultures of the proper bacteria are mixed with salt solution and some such preservative as carbolic acid, filtered into glass containers, and then subjected to a temperature of 140° to 150° for an hour to kill the bacteria.

The substance used in vaccination is called smallpox "vaccine" from the Latin *vacca* meaning "cow." This is no longer obtained, as in Jenner's day, from other human beings; but is cultivated in calves, under expert care, to make sure of its purity. From its discovery down to the present day, vaccination has had many opponents, but its value has become so firmly established that most civilized countries make it compulsory. In the United States the question of vaccination is for the most part left to local and state authorities. Vaccination will give a child or grown person immunity from smallpox for several years, but the treatment must be repeated from time to time to give permanent protection. So far-reaching have been the effects of this discovery that even when a person does have smallpox today, it is usually a very mild form of the disease, and few deaths are reported.

Vaccines and vaccine treatments have been developed for other diseases since the days of Jenner. These are sometimes called "bacterins." Among the principal ones are those for typhoid, influenza, and pneumonia. Vaccines are also used to give animals immunity from such ailments as hog cholera and anthrax. (For an explanation of the vaccine principle *see* Germ Theory of Disease.)

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Vacuum (*văk'yu-ŭm*). One of the hardest things in the world to get is "nothing." Men have tried their best to get a vacuum; that is, a bit of space with no matter in it (from Latin *vacuus*, meaning "empty"), but they can never succeed. For, as the old saying puts it, "Nature abhors a vacuum." And when we do succeed in getting most of the matter out of a particular bit of space, Mother Nature at once sets about filling it up.

It is easy to create a partial vacuum, and we are all familiar with the noisy way in which it is filled with air the instant nature is allowed to have her way. When you break an electric light globe, the loud "pop" you hear is the noise of a partial vacuum closing up. The air, which has been held out by the strong sides of the glass, rushes in so suddenly that it makes a noise like clapping your hands together. If you pull a cork suddenly from a bottle, you first create a partial vacuum, which fills up with the same kind of a noise. The noise of thunder is believed to be due to the fact that the lightning creates a vacuum as it flashes through the air, and that the air comes together with a clap. The pressure of the atmosphere explains this tendency of air to rush into empty spaces.

The simplest way of creating and studying a vacuum is with the suction air pump. By reading the article on Air and its properties, you will get a fair idea of what happens in the absence of air, that is, in a vacuum.

The commonest use of a vacuum is in the electric light bulb. If these bulbs had air in them, the tiny glowing wire inside would burn up and break off immediately. But when we remove the air with its oxygen, which is necessary for anything to burn (*see* Fire), we get the steady glow of the wire heated white-hot by electricity (*see* Electric Lighting).

A VACUUM BOTTLE

The reason a vacuum bottle keeps things hot or cold is that it is really two bottles as you see, one inside the other, with a vacuum between the two. This keeps the inside heat from getting out, in the case of hot liquids; or the outside heat getting in, in the case of liquids you want to keep cool.

Glass tubes possessing a high degree of vacuum are also used extensively in studying the action of electric currents. Small quantities of various gases are let into these tubes and electricity is passed through them, sometimes with amazing results. The X-ray tube is an example of such use (*see* X-Rays).

A vacuum walled in by reflecting glass has been found more impervious to heat than any other barrier. This is the principle of the thermos bottle and other similar devices. The inner glass container for things to be kept hot or cold is jacketed by a vacuum between it and the outer container.

A vacuum may be thought of as a space released from the atmospheric pressure which weighs down surfaces and retards evaporation. Because a partial vacuum speeds up evaporation, the vacuum principle has been used in certain systems of artificial ice-making (*see* Refrigeration) and in the vacuum pan. This is a steam-jacketed chamber partially filled with some substance to be evaporated, as sugar-cane juice. A partial vacuum is produced, which hastens evaporation at a temperature low enough to eliminate the danger of burning.

The tendency of air to rush in and fill a vacuum is made use of in the common vacuum cleaner. This consists of a suction fan or exhausting pump, usually operated by electricity, which creates a partial vacuum in the instrument. The outside air sweeps in through the nozzle and carries with it any dust or dirt it meets on the way. In large buildings, there is usually a big central pump connected by a pipe system to each floor. Long hose attachments ending in a nozzle can then be carried into the separate rooms. For household use a type of vacuum cleaner has been invented which carries its own small motor operated by the electric light circuit. A large bag is attached to the handle of the cleaner, which collects the dust which is sucked up by the fan. (*See also* Electricity; Gas; Heating and Ventilation.)

Valen'cia, Spain. Every morning at daybreak the dwellers of the fertile plain in which lies Valencia, one of Spain's two great Mediterranean ports and her third largest city, begin listening for the great bell of the cathedral. Its ringing hour by hour is the sign of each man's turn to release the waters into the channels that make his dry land fertile. And every Thursday is held the oldest tribunal in Spain, the "tribunal of the waters"—a meeting of the peasants themselves to decide whether any have used the water contrary to regulation. Under such careful irrigation the plain (or *huerta*, as it is called in Spanish) yields four or five crops a year, and seems like a great orchard with its groves of citron, orange, and mulberry trees, the last named for the silkworm, to which Valencia owes much of its prosperity.

Set in this garden region which the Moors trained to fertility many centuries ago, Valencia is one of the most Moorish-looking of Spanish cities; for many of its ancient streets are winding and narrow; and its

blue sky is cut by white, gold, and blue domes and towers that overtop the modern stone buildings of commerce. The city lies two and one-half miles from the mouth of the Guadalaviar River, and its harbor (El Grao) is one of the safest on the whole Mediterranean. It exports rice, melons, oranges and other fruits, wine, silk, and olive oil. Silk spinning is one of the leading industries, and the Silk Exchange, a beautiful Gothic building, is one of the best surviving examples of civil architecture in the Middle Ages. Other industries are hemp and linen weaving, tobacco manufacture, and the making of the bright-colored glazed bricks known as *azulejos*, which play so important a part in the beauty of Valencia itself and other Spanish cities. Valencia is also noted as the seat of one of the foremost universities of Spain.

Blasco Ibañez, the novelist, is a Valencian by birth, and in his books 'The Cabin' and 'Mare Nostrum' you may read of the life on the huerta and the spell of the Mediterranean as a Valencian sees them. Population, about 245,000.

VALLEY. Like other land forms, river valleys are constantly changing. At the same time that the river is deepening its bed, other forces—rain, frost, wind, and the atmosphere—are loosening the material on the valley walls so that it falls into the stream and is carried away. The form of a valley is determined by the relative rapidity with which these two agencies of deepening and widening carry on their work. At first the deepening will proceed more rapidly. When, however, the stream approaches the level of the body of water into which it empties, it grows more sluggish and deepening is halted; but the slow stream aids the process of widening by swinging from side to side when confronted by obstacles in the channel. In arid regions, as in western United States and Mexico, the deepening forces far outstrip the weathering process, and deep gorges are formed (*see* Canyon).

Valleys are classified according to their form as young, mature, and old. A young valley is narrow with steep sides, and carries a vigorous stream. A mature valley is deep and open, having flaring sides and gentle upper slopes; and an old one is very wide, with a broad bed and extremely low slope. These terms, however, do not refer to years but to stages of development. A river working on soft material may bring its valley to old age in less time than that required by a stream opposed by hard rocks, and a single river valley may be both "young" and "old" in different parts.

The word "valley" does not necessarily indicate the presence of a river. The term is applied to depressions made in other ways, and to long narrow "structural valleys" created by movements of the earth's surface. Glen, dale, dell, and dingle are somewhat poetic words for small secluded valleys.

VALLEY FORGE, PA. The little village of Valley Forge, famous as the winter quarters of Washington and his army during the terrible winter of 1777–78, lies about 20 miles northwest of Philadelphia.

The American army of about 11,000 had encamped there in December 1777, after the battles of Brandywine and Germantown. The place was chosen partly because it lay between the British army in Philadelphia and the Continental Congress in York, Pa.

That winter was the darkest time of the whole Revolutionary War. "Nearly 3,000 men were unfit for duty because they were barefoot and otherwise naked. Hundreds of horses starved to death. Men yoked to the provision wagons like oxen brought meager relief to their starving comrades, who lay in huts or wigwams of twisted boughs." Washington pleaded with Congress to relieve the suffering, but Congress was inefficient or powerless. Many of the soldiers succumbed to the hardships, and over 2,000 deserted to the enemy.

The time spent at Valley Forge was not lost to the army. During the winter there arrived in the camp Baron Steuben, an officer of the famous army of Frederick the Great of Prussia, and before spring he had made of the American troops a well-trained and efficient army.

Today a part of the old camp ground has been converted into the Valley Forge Park, in which still stand Washington's headquarters, together with other old and modern buildings and numerous memorials of that trying time.

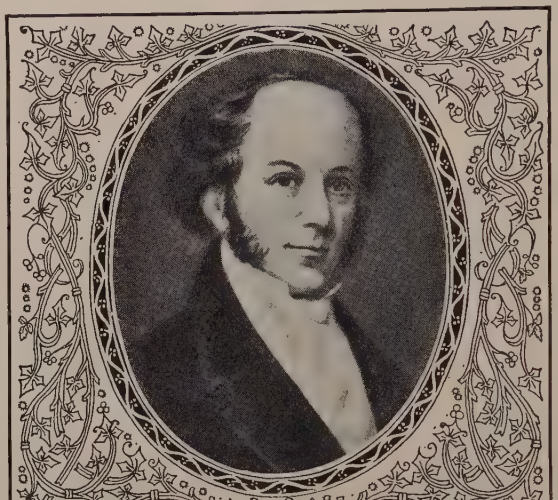
VALPARAISO (*văl-pȧ-rī'zō*), **CHILE.** Ships from all over the world may be seen in the broad open bay of Valparaiso, for it is the largest and busiest port on the Pacific coast south of San Francisco. The harbor offers good protection from southerly and westerly storms, but the bay is open from the north, where it is about 2½ miles wide. Its great depth long retarded the efforts of the government to build breakwaters to protect shipping, but extensive improvements were begun in recent years.

"Paradise Valley"—for that is the meaning of "Valparaiso"—is a singularly inappropriate name for this crowded commercial and manufacturing city, set in a semicircle of rugged barren hills. Looking at it from the bay, one sees first the business section on the narrow strip of shore; then farther back, climbing the hills, crowning their tops, and clinging castle-like to the steep cliffs, you behold most of the residences. Especially conspicuous is the natural fortress upon which stands Chile's naval academy. Elevators are used in some places to ascend these cliffs, while elsewhere double-decked electric cars and motor busses give excellent transportation. Owing to the topography, many of the streets are winding. The city has several times been severely damaged by earthquakes, notably in 1855.

The Trans-Andean railroad, which tunnels the Andes and runs thence to Buenos Aires on the other side of the continent, adds much traffic to the port. The factories turn out freight and passenger cars, locomotives, foundry and machine-shop products, clothing, foodstuffs, furniture, carts and wagons, and refined sugar. Population, about 215,000.

The CHARACTER *and* CAREER *of* VAN BUREN

VAN BUREN, MARTIN (1782–1862). The "Little Magician" of Kinderhook, as Martin Van Buren was called, was one of the unfortunate presidents of the United States. Coming to the White House in 1837, as the eighth to hold that office, he reaped in the panic of that year the "whirlwind" which had been sown by his predecessor and sponsor, Andrew Jackson. The odium which attached to his name at that time for years rendered any just estimate of Van Buren impossible, but today he is regarded as a real statesman, as well as a politician of the spoilsman type. Woodrow Wilson in his 'History of the American People' gives this estimate of Van Buren: "Not a little strength of character underlay Mr. Van Buren's bland exterior, his conciliating manners, his air of sweet accommodation. He was also, in his way, a consummate master of men. He mastered them by insight, by intimate and friendly counsel, and by knowing the end he sought. He did not rule or dominate by force of will. But that slender little gentleman was always courteous, always placid, always ready to listen and wait to get his way." Calhoun, however, asserted that with him "justice, right, patriotism, were mere vague phrases."



MARTIN VAN BUREN

VAN BUREN'S ADMINISTRATION
1837-1841
Financial Panic (1837).
Continuation of the War with the Seminole Indians.
"Aroostook War" between Maine and Canada (1838–1839).
First Photograph taken in America (1839).
Process of Vulcanizing Rubber discovered (1839).
Subtreasury established (1840).
"Hard Cider" Campaign resulting in Whig Victory (1840).

Martin Van Buren was a native of the state of New York, and as his name indicates, was of Dutch descent. His father was a farmer, and according to some was a tavern-keeper at Kinderhook, near Albany. The boy's schooling was obtained in the village school and in Kinderhook Academy, but at 14 years of age he left school and entered a law office as an errand boy. For seven years he served an apprenticeship in law offices at Kinderhook and Albany, and at the end of that time he was admitted to the bar.

Though he proved a successful lawyer, his chief interest centered in politics, in which field he first appeared in 1803 as a supporter of the Jeffersonian candidate for governor of New York. Political parties in that state were already beginning to change and in the factional struggle which followed, Martin Van Buren took an active part. In the "Albany Regency," a group of politicians who ran New York, Van Buren was a leader. From this came his nickname, "King Martin the First." During this period he served in the state legislature and in Congress.

With his election in 1828 as governor of New York, Van Buren gave up his law practice; but he held the position of governor for only two months, resigning it to become secretary of state under President Jackson. This step marked his real entrance into national politics. As supporter and campaign manager of Jackson, he rose rapidly through the different steps—secretary of state, minister to England, vice-president, and finally president. In the first three positions he did nothing noteworthy, but he became marked as the destined successor to Jackson in the presidency. It was to keep him out of factional disputes and so render him an available candidate for the presidency in 1836 that Jackson in 1831 appointed him minister to England. The Senate, however, spoiled this plan by refusing to confirm the nomination, though Van Buren had already left for his post in London. The action of the Senate did not hurt Van Buren, for the next year he was elected vice-president, and four years later succeeded Jackson in the presidency, with R. M. Johnson as vice-president.

Van Buren entered his term of office pledged to follow the footsteps of his predecessor. By so doing he not only continued the "spoils system" of politics but he assumed the burden of all of Jackson's mistakes. In a few short months the panic of 1837 began. Banks closed their doors; business houses failed; industry was paralyzed. The crisis showed that Jackson's policy of depositing government funds in private banks was a dangerous proceeding because the surplus money tempted the bankers to engage in speculation, and if these speculations failed the government lost its money. To provide a safer means of keeping government funds, Van Buren favored the establishment of an "independent treasury," and after a three years' fight with Congress a bill providing for this was passed in 1840.

Another unwelcome inheritance from the Jackson administration was the most fierce and costly of any of the Indian wars, the Seminole War in Florida (1835–42). A large part of this tribe refused to cede its lands and move to Indian Territory in accordance with the provisions of the treaty of 1834. It was not until the government had spent thousands of lives and $10,000,000 that the Indians were finally subdued. Meanwhile Van Buren was confronted with the "Aroostook War," a conflict between Maine and Canada over the Northeast Boundary question. In 1838, Maine fortified the line which she claimed and prepared to fight if necessary. It was chiefly due to Van Buren's good judgment that actual conflict was averted and the matter left to settlement by Great Britain and the United States. No small amount of credit is also due this unpopular president for his executive order establishing a ten-hour working day in all government plants.

But the people, still suffering from the panic of 1837, saw in Van Buren's administration only failure to relieve their distress. In the election of 1840 the Whigs, putting all their emphasis on the hard times, won a decided victory after a campaign famous for its enthusiasm (*see* Harrison, William Henry); and Van Buren's public career was ended at the end of his single term as president. But he still maintained his interest in politics. He was a Democrat, but he opposed the annexation of Texas, and approved of the Wilmot Proviso which forbade slavery in the territory acquired from Mexico. This last stand led to his nomination for the presidency in 1848 by the "Barn-Burners" and Free Soil parties, but he was disastrously defeated. He maintained his connection with the Democratic party for the rest of his life; but after Lincoln's election in 1860 he supported him in the dark days of the Civil War. He died in 1862, believing that the Union cause would triumph.

VANCOU'VER, BRITISH COLUMBIA. When one sees the wonderful harbor of Vancouver, the metropolis of British Columbia, filled with ships from China, Japan, Australia, and India, it is hard to realize that in 1880 the site of the present city was covered by a trackless forest. The city owes its existence to the Canadian Pacific Railway, and was laid out by officials of the railroad to be the western terminus. In 1886 the little frame buildings of the new town were destroyed by fire, and on their ruins were erected substantial gray stone and brick buildings.

Built on a peninsula projecting into a spacious arm of the ocean, the city has 80 miles of water frontage. It has another great industrial advantage in the unlimited electric power which may be made available by harnessing the torrents of the mountains which surround the city. Lumbering, mining, fishing, paper and pulp manufacture, ship-building, iron and steel manufactures, sugar refining, and meat and fruit packing are some of the leading industries of the Vancouver district. It is the center of the Canadian salmon-canning industry.

Because of its location on one of the best harbors on the Pacific coast, served by several great railways, and because it is the center of the lumber manufactures of the Pacific Northwest, Vancouver has had a marvelous growth as a commercial and industrial center, and now ranks fourth among the cities of Canada, with a population of more than 115,000.

Vancouver is remarkable for the beauty of its surroundings. It has many delightful drives following the wooded shores of the ocean inlets, and leading into the mountains that surround it on three sides. The fame of Stanley Park, with its giant trees, has gone around the world. On one of the splendidly picturesque nearby sites, a headland overlooking the city and sea, are being erected the buildings of the newly organized University of British Columbia.

Across the Straits of Georgia from the city lies the island of Vancouver, named after the British navigator George Vancouver, who sailed around it in 1792. The island, which has an area of about 20,000 square miles—about the size of Nova Scotia—is the largest of the countless islands which fringe the coast of British Columbia. It has rich deposits of iron and copper ores, and its coal mines supply the whole Pacific coast. Dense forests of magnificent timber abounding in big game cover most of its surface, and its rivers yield gold and are a potential source of incalculable water-power. Where the land has been cleared it produces cereals and fruits abundantly, as well as providing excellent pasturage. The chief city is Victoria, the capital of British Columbia (*see* Victoria).

VANDALS. Looted churches, wrecked buildings, and shattered statuary marked the path of these German barbarians of the early Middle Ages. So wantonly did they plunder the country through which they passed that ever since the word "vandal" has meant one who recklessly destroys property.

At the beginning of the 5th century A.D. the Vandals left their home on the Baltic Sea and joined the German migrations to the south and west. Crossing the Rhine, they invaded Gaul, where they were defeated in a great battle with the Franks, and were glad to cross the Pyrenees into Spain (409). Here they remained for about 20 years, until Genseric (Gaiseric) became king. Short of stature and with a limping gait, this man certainly did not possess a commanding appearance, but his genius for war and leadership made him one of the great barbarian rulers. For 50 years he was the terror of Rome and Constantinople.

About 428 Genseric gathered up his people and moved them, together with all their possessions, across the Strait of Gibraltar into Africa. It is said that this exodus was due to an invitation from a discontented governor in the African provinces of Rome, who supplied the ships for the passage. If this was so, he must soon have repented of his folly. Genseric promptly conquered all of the Roman territory and even established his capital at Carthage, which the Vandals continued to hold for nearly a century.

Not content with his conquests by land, Genseric built a fleet of ships which roved up and down the Mediterranean preying upon the luckless vessels that crossed their paths. When, in 455, Genseric received an appeal for help from the widowed Empress Eudoxia, the head of a faction in Rome, he gleefully embarked in his pirate fleet and sailed north to capture Rome. This was accomplished without difficulty and for 14 days the Vandal army systematically gathered up the wealth of the city to carry it away to Carthage. Nor were gold and silver their only booty. Eudoxia and her daughters were taken captive, and one of the girls was later married to Genseric's son. Expeditions sent out to punish Genseric failed disastrously and the barbarian king ruled in the secure possession of his conquests until his death in 477.

The Vandals continued to be a source of terror for the Romans, both because of their warlike depredations and because of their persecutions of the orthodox Christians. The Vandals themselves had been converted to the Arian form of Christianity and lost no opportunity to attack the other party. At last, in 533, Justinian sent his great general, Belisarius, against them. After several battles he conquered them and carried their king to Constantinople to march through the streets before his triumphal car, a captive. Most of the men were drafted into the Roman army. Those who remained in Africa intermarried with the Roman provincials and the Vandals disappeared from history.

VAN DYCK (VAN DYKE), SIR ANTHONY (1599–1641). In his wonderful series of portraits this gifted painter left a pictorial history of his colorful age such as we have for few other periods. Through the work of his master-hand we are as familiar with the faces of Charles I of England, Queen Henrietta Maria, and their delicate-featured children as we are with those of our contemporaries. Immortalized by his art, the dashing and splendid lords and ladies of the English court—so many of whom lost their lives in the struggle between Cavaliers and Puritans—live again for us and will continue to live as long as paint and canvas hold together. His magic brush also perpetuated for us the haughty features and sumptuous apparel of the patricians of Genoa, and of the kings and queens and dignitaries of most of the courts of Europe.

Besides this unsurpassed collection of portraits, on which his fame chiefly rests, Van Dyck also painted scores of great church paintings and scenes from history and mythology. Works of his incredibly prolific and industrious hand are found in nearly every important gallery of Europe and America.

VAN DYCK
Painter of Kings and Queens

From this Flemish artist, who spent less than nine of his twenty-five years of production in England, stems the English school of portrait painters. Reynolds, Gainsborough, and their followers derived their chief inspiration from him. So thoroughly is he identified with the art history of England that it is hard to realize that his work at the English court occupied only about one-third of his productive life.

The characteristic note of Van Dyck's portraits is distinction. A mysterious grace and delicacy and charm pervade them all. His people are patricians to their finger-tips. The figures are tall and stately, with heads proudly poised and long tapering fingers. Gleaming jewels sparkle on their hands and breasts, and they are clothed in lustrous satins and rich brocades. As a painter of children he was at his best. With them he obtained effects of naturalness and vivacity missing from many of his portraits, with their rather stiff constrained poses. He delighted in dogs and horses and often brought them into his portraits, with gorgeous backgrounds of splendid gardens and marble terraces and balustrades.

Van Dyck's genius matured early. He began to study painting in Antwerp at ten, and about ten years later he entered the studio of Rubens, the greatest painter of the age, to assist the master in carrying out his great compositions. Already his skill was so great that in portraiture he was a worthy rival of his great employer. His fame spread to England and he was brought to King James's court. This first visit to England was brief, and the young painter soon went to Italy, where he spent four years studying the great masters, especially Titian, and rapidly producing scores of his magnificent religious and mythological canvases. During these years he also painted the wonderful series of portraits of the patricians of Genoa.

In 1626 he returned to his native city, a famous and fashionable painter. For six years he remained there, painting princes and nobles and rich burghers, with occasional visits to other cities of Europe to execute commissions. Then came the invitation to the court of Charles I. He was knighted, given a pension, and had the King and Queen for his first sitters. So great did his vogue become that he set up a studio like Rubens, with assistants to block in the painting from his preliminary sketches. In the later years of his life he grew careless and allowed many inferior and ill-finished paintings to go out under his name.

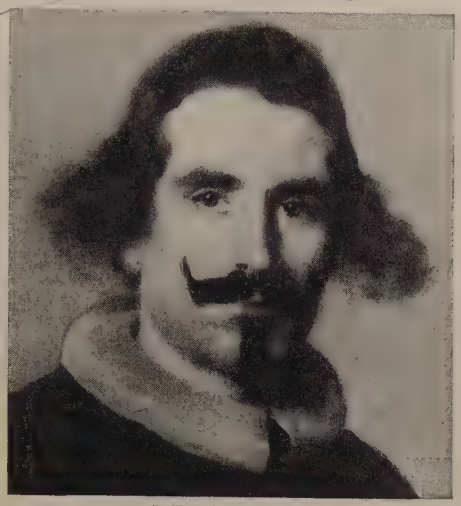
In 1640, the year that Rubens died, Van Dyck went to Paris, hoping to get a commission to decorate the Louvre. He failed, and returned to London, where he died the following year.

VANILLA. When the Spaniards first landed in Mexico, they found the Aztecs flavoring a strange substance, chocolate, with an equally strange sweet-smelling extract obtained from the fermented pods of a plant native to the country. This new flavor was vanilla, today the commonest of all flavoring extracts used in baking, confectionery, etc. It is also used largely in making perfumes.

The vanilla plant is a climbing orchid, extensively cultivated in Mexico, Central America, the West Indies, Ceylon, Tahiti, East Africa, and elsewhere. The seedlings sprout in the ground and send up slender twining stems which climb the trees on which they live, to a height of 20 to 30 feet, clinging by fibrous roots. The species from which the most valuable vanilla of commerce is obtained has slender pods from 6 to 10 inches long. These pods, picked before they are fully ripe, are filled with oily pulp surrounding the minute seeds. They are quite scentless when picked. The aroma, due to the presence of vanillin, develops during the slow curing and fermentation of the pod. When the vanilla pod or "bean" is ready for the market, it is chocolate-colored, wrinkled, slender and pliable, and in the best qualities, known as "frosted," the pods are covered with tiny crystals of the vanillin. Vanilla extract is prepared by dissolving the vanillin in alcohol.

Scientific name of common vanilla plant, *Vanilla planifolia*. It bears bright green oval fleshy leaves. The flowers are fragrant and greenish white. Several inferior qualities of vanilla are put on the market, usually the product of *Vanilla pompona*, which bears a shorter and thicker pod, and has a less delicate flavor. A cheap substitute is also prepared from the tonka bean, which is the seed of a tall tree found in Guiana, Venezuela, and neighboring countries. The tonka bean is also much used in perfumery. Synthetic vanillin is now made by chemical processes.

VARNISH. Solutions of certain gums or resins in alcohol, linseed oil, or the like, used to produce a shining transparent hard coat or surface, are called varnishes. They are named according to the solvent used, as spirit varnish, where the solvent is alcohol, acetone, etc.; turpentine varnish; and oil varnish, where drying oils such as linseed, poppyseed, etc., are used. They are also named from the gum used, as amber varnish, lac varnish, copal varnish, etc. The resins commonly used for spirit varnishes are shellac, produced by the lac, a scale insect of the Orient; mastic from a small evergreen tree of the Mediterranean region; sandarach, the resin of the tear tree of North Africa and Australia; and dammar, the product of several coniferous trees of the Molucca Islands. For other varnishes amber and copal, resinous fossil substances, are used. (*See* Paints and Varnishes.)



VELASQUEZ
"The Painter's Painter"

VELASQUEZ (*vā-läs'kĕth*), DIEGO RODRÍGUEZ DE SILVAY (1599–1660). "There is only one thing lacking in this picture," said King Philip IV of Spain, as he examined with delight the latest masterpiece of his famous court painter Velasquez. It represented his little daughter—surrounded by her family, her ladies-in-waiting, her dwarf, and her dog—posing while Velasquez is shown standing at his easel. "Give me the brush," he added. Wonderingly Velasquez, "king of painters," obeyed; and Philip IV painted upon the breast of the artist in the picture the red cross of the Order of Santiago, the highest honor attainable by a Spanish nobleman.

It is thus, we are told, that the king hinted of the honor he was to bestow three years later upon Velasquez, Spain's greatest painter and one of the supreme artists of all time. So superb was his mastery of technique, so vigorous and independent his individuality, that his influence on the art of Europe has probably been greater than that of any other painter.

Velasquez was a lawyer's son of noble Portuguese descent. He was born in Seville the same year that Van Dyck, the great Flemish painter, was born at Antwerp. In his early teens the boy, already well educated, began to study art with one of the famous painters of his own city. But the young artist, who stoutly declared, "I would rather be the first painter of common things than second in higher art," engaged a peasant boy for a model, learned much from nature, and was to a great extent his own master.

After his marriage at 19, Velasquez went to Madrid. When he was 24, he painted an equestrian portrait of Philip IV, the melancholy art-loving king, who thereupon became his friend and patron for the 36 remaining years of his life.

The artist made two visits to Italy, the first in 1629, when he copied masterpieces in Venice and Rome; the second 20 years later, when he bought many of the paintings of Titian, Tintoretto, and Veronese, and 300 pieces of statuary for the Royal Gallery of Spain. Except for these journeys, his life was spent at Madrid as court painter. His more than 200 paintings include landscapes, mythological and religious subjects, and scenes from common life (*genre* pictures); but most of them are magnificent portraits of royalty and court notables, ranking with those of Titian and Van Dyck. Duties connected with royal offices also occupied his time, particularly those as marshal of the royal apartments, which involved the responsible task of looking after the royal quarters at all times, and of planning fêtes and ceremonies.

In 1660 Velasquez had charge of his last and greatest ceremony—the wedding of the Infanta Maria Theresa with Louis XIV of France. This was a most elaborate affair, the princess traveling with a cavalcade 18 miles long, and the preparations and ceremonies lasting from March to July. Fatigued with these labors, Velasquez contracted a fever from which, on August 6, he died.

Velasquez was a modest, sincere, kindly genius, who has rightly been called "the noblest and most commanding man among the artists of his country." He was above all a master realist. Truth was his ruling passion, and no painter has surpassed him in the ability to seize essential facts and fix them on canvas with a few broad sure strokes. "His men and women seem to breathe," it has been said; "his horses are full of action and his dogs of life." Because of his consummate craftsmanship, he is called "the painter's painter." The virility and large mental grasp of Velasquez sharply contrast with the less robust and less intellectual talent of his great pupil Murillo, whom he befriended when Murillo was a poor and unknown youth. Velasquez' passion for reality, his power of focusing on essentials, and his ability to represent what he saw by the simplest means powerfully influenced Whistler and others.

Velasquez' most famous paintings today are found in Madrid and in other important galleries. They include 'The Crucifixion', 'The Spinners', 'The Maids of Honor', 'Pope Innocent X', 'Philip IV', 'Don Carlos on Horseback', 'The Infanta Marguerite', and the great historical picture, 'The Surrender of Breda'.

VENEER. When thin sheets or veneers of valuable hardwood are glued under pressure upon a cheaper wood they give the whole the appearance of the more costly wood. There is little "solid" furniture today, as compared with olden times. A genuine solid mahogany bedroom set costs a small fortune, yet it may not be so handsome as a veneered set. Furniture of this sort is not only cheaper, but, the manufacturers assert, lends itself to remarkably beautiful effects in grain and figure.

Three methods of veneer-cutting are used. In one a thin circular saw peels the veneers from a whole log in layers as thin as cardboard. In the second or "slicing" process, the log is softened by boiling and as it revolves rapidly a long razor-edged knife cuts a veneer layer—as thin as one thirty-second of an inch—from the entire log, just as paper is unwound from a roll. In the third or "reverse roll" process the log is softened, cut in two lengthwise, and a huge knife begins to cut on the edge of the half log, the slices being successively wider until the middle is reached and then gradually narrower. It is in this manner that the beautiful tree and fountain effects are obtained in walnut and mahogany.

Mahogany is most often used for furniture veneers, but almost any wood of value can be so treated. A single log of bird's-eye maple or a burl or knot of black walnut, when cut into veneer, may be worth hundreds of dollars. Basswood and other soft woods are also cut into veneer, which is used for making wooden dishes and picnic plates, berry boxes and baskets, and the like. Very light and strong trunks are built of such veneer by gluing three or more sheets together, with the grain running in different directions. Similar methods have been devised for building up gunstocks. Many packing cases are made of thin veneer, with a heavier framework at the edges.

VENEZUELA'S PLAINS *and Cloud-Topped* MOUNTAINS

A Land of Incalculable Resources and Opportunities—The Internal Quarrels that Keep It Poor and Undeveloped

VENEZUELA (*vĕn-ĕ-zwē'lȧ*), UNITED STATES OF. The commanding geographical position of Venezuela, at the north of the continent of South America, gives it advantages which promise some day to make it an important center in world trade. It has 800 miles of coast on the Caribbean Sea, the gateway to the Panama Canal, and is almost a week nearer the United States and Europe by steamer than the Argentine Republic. But so far the Venezuelans have spent most of their energies in fighting one another for political power, and have done little to develop their immense resources. How greatly Venezuela has suffered from these activities is indicated by the oft-heard statement that "no president of Venezuela has ever attained office by legal election, or left it without a revolution."

With its area of about 394,000 square miles, Venezuela is larger than Texas and New Mexico combined. A great part is suitable for stock-raising and tilling, and there are also rich deposits of gold, iron, coal, petroleum, asphalt, and other minerals. But Venezuelan industries are only in their infancy. A few decades ago vast herds of cattle roamed the plains or llanos, and the *llaneros* (cattlemen) rivaled in hardiness and skill the *guachos* of Argentina and the cowboys of the United States. But the llaneros nearly disappeared in the War of Independence and later civil wars, and the herds are now small. Modern refrigerating plants recently established in this region have, however, given an impetus to raising cattle for the export meat trade. These grassy llanos, which cover more than one-fourth of the republic's total area, extend along the Orinoco River almost from its delta to the Andes Mountains in the northeast. A second division of the country in the west and south is the Guiana highlands, comprising nearly half of the total area. Here are forest-covered plateaus, broken by chains of mountains and hills and inhabited only by scattered tribes of uncivilized Indians. A third division, comprising the remaining fourth, is the mountain

CARÁCAS PERCHED HIGH AMONG THE MOUNTAINS

The capital of Venezuela is only six miles from the sea, yet so steep is the approach that the valley in which it lies is 3,000 feet above sea-level. It is one of the oldest American cities, having been founded in 1567 under the name of "Santiago de Leon de Carácas." Despite a turbulent history, during which it was destroyed once by the British and once by the French, and despite the great earthquake of 1812 which shook down half the city, killing 12,000 persons, Carácas is today one of the most attractive capitals in the world. It was the birthplace of Simon Bolivar.

districts of the north and west, where most of the people live. The Sierra Nevada de Merida, a branch of the Andes, enters Venezuela from Colombia and strikes northeast in two parallel ranges, inclosing fertile valleys. Two similar parallel ranges, known as the Maritime Andes or the Caribbean Hills, continue east along the coast. The valley of the Caribbean Hills is the most thickly populated part of the republic, and in it lies the capital Carácas. This city is reached from its seaport La Guaira by one of the most interesting railways in the world, which twists and turns in sharp curves up the wall of granite nearly a mile high that separates Carácas from the coast. The airline distance from the port is only six miles, but the railway travels three times this distance.

As the birthplace of Simon Bolivar, the liberator of South America, Carácas was the first spot in South America to free itself from the Spanish yoke. It is a beautiful city, with numerous fine public buildings and many great squares. The life of the city centers about the Plaza de Bolivar. Here are the cathedral (built in 1614), the archbishop's residence, the post-office, and the famous "Yellow House" in which the president of the republic lives. Its population is about 90,000.

The Lake Maracaibo basin, between the Sierra de Merida and the northern coast, is one of the richest parts of the republic. Several short rivers and streams from the mountains empty into this shallow lake, somewhat larger than Lake Huron, and a channel, which is impeded by sand bars, connects it with the Gulf of Venezuela. On its shores are clustered huts, raised on piles, in which the Indians live as they did when the white men first came about 400 years ago. The name Venezuela, which means "Little Venice," was suggested by these lake-villages, for they reminded the early explorers of the Italian city of Venice.

A network of rivers, which unite to form the Orinoco, flows from the eastern and southern slopes of the mountains. This is the third greatest river system of the continent, being surpassed only by the Amazon and the La Plata. Through a fan-shaped delta of about 50 mouths, the Orinoco empties into the Atlantic. Above the delta the huge mysterious stream, shadowed by impenetrable forests and inhabited only by wild Indians, is still unexplored for most of its 1,600 miles. In flood times the tributaries from the llanos inundate great tracts, drowning thousands of cattle, while in dry seasons the rivers often disappear entirely, so that vegetation withers and cattle perish of thirst. When the waters of these streams are stored up in great reservoirs for use in the dry seasons, the llanos will become a cattle-raising district which will rival Argentina.

The climate of Venezuela, as in the other republics of the Andes, varies as one ascends from sea-level,

Though the country is wholly within the tropics, arctic cold prevails the year round on the mountain-tops, while at altitudes of 2,000 to 7,000 feet the climate is temperate. The coast and the lowlands are intensely hot, except as modified by the trade-winds.

Coffee-growing is the chief industry. Other agricultural products are cacao, sugar-cane, cotton, corn, beans, tobacco, and wheat. Rubber trees are found in the forests, but rubber collection has been little developed. Some gold and copper have been mined, but Venezuela has scarcely started to tap her deposits of iron, coal, and oil. One great source of revenue is the famous asphalt lake in the state of Bermudez, whence thousands of tons of asphalt are sent to the United States for road-making every year. Little of this material is used in Venezuela, as the building of good carriage roads has only begun. As yet the roads of the country are indescribably poor, for the most part mere bridle-paths. Venezuela is also greatly in need of railroads; so far only a few hundred miles have been built. Steamboats also are few, though the country has about 6,000 miles of navigable rivers.

Venezuela is believed to have a larger proportion of *mestizos*, of mixed white and Indian descent, than any other South American republic. The pure whites number only about 10 per cent of the whole population of nearly 3,000,000, while the *mestizos* are estimated at 70 per cent. The rest are Indians, chiefly of the Carib and Arawak tribes. The African slave trade once prevailed on the coast, so there is a considerable admixture of negro blood. About three-quarters of the inhabitants cannot read and write. There are few schools except in the larger cities and towns, most of which are situated near the coast.

VENEZUELA AND HER LIBERATOR

Above is a statue of the "Washington of South America," Simon Bolivar, which stands in Carácas. Below is a relief map of Venezuela. Notice the great Orinoco River with its many tributaries and mouths.

The government is nominally a federal republic, like the United States, but in practice it works very differently. Every male citizen over 21 is entitled to vote for members of congress, but the elections are mere forms. The candidates are chosen by a little oligarchy that rules the republic, and the elections follow their arrangements. Each state has its own president and legislature, and is nominally self-governing. But almost absolute authority is exercised by the national president, the two vice-presidents, and the cabinet. The state religion is Roman Catholic, and the president has the power of barring out foreigners engaged in religious work which does not meet his approval.

Venezuela's troubled history begins with 1498, when Columbus coasted part of its shores on his third voyage. The people remained under Spanish rule for three centuries. A republic was declared in 1811, with the patriot leader Francesco Miranda as dictator. But Miranda was captured by the royalists, and it was only after twelve years of fighting, under the leadership of Simon Bolivar, that the Spanish power was finally broken. For a few years Venezuela was united with Colombia and Ecuador, but soon broke away. Since then its history has been marked by a series of dictatorships and revolutions. From 1870 to 1890 supreme power was in the hands of the notorious Guzman Blanco, who made and unmade presidents as he pleased. Cipriano Castro also ruled despotically from 1900 to 1909, when he was overthrown by a revolution.

Boundary disputes with British Guiana came to a head in 1895, and the threat of Great Britain to use force called forth President Cleveland's famous message to the Congress of the United States. In this he

stated, in effect, that any attempt by Great Britain to enforce her claims without recourse to arbitration would be considered a violation of the Monroe Doctrine and might lead to war with the United States. The dispute between Great Britain and Venezuela was then arranged by arbitration. A few years later (1903) Castro's overbearing violation of foreign rights led Great Britain, Germany, and Italy to declare a blockade of Venezuelan ports. When President Roosevelt protested that this step also was a violation of the Monroe Doctrine, Great Britain and Italy at once consented to refer the dispute to arbitration. Germany declined to arbitrate and Roosevelt announced his intention of sending an American fleet to the Caribbean, which at once brought Germany to terms. Castro plunged his country into new difficulties in 1908, and the offended nations practically paralyzed Venezuelan commerce by instituting a quarantine against the nation's ports. In the midst of these troubles Castro fled to Europe. Gomez, who succeeded him, was able to maintain order, and instituted several beneficial measures of sweeping character. Strengthened by his reëlection for a second six-year term in 1915, Gomez remained the dominant leader during the World War of 1914–18, in which Venezuela maintained neutrality. The war caused considerable hardship in the country, and made new tariff and revenue measures necessary. (*See* Andes Mountains; Asphalt; Bolivar, Simon; Caribbean Sea; Monroe Doctrine.)

SUCH A PLACE FOR FRUITS!

Venezuela has a wonderful variety of fruits, owing to the range of its climate. On the lower levels grow bananas, oranges, lemons, pineapples and other tropical fruits, while higher up are the fruits of temperate climes, such as peaches, apricots, quinces, and strawberries. This jovial fruit vendor does business in the market place at Caracas.

The QUEEN CITY *of the* ADRIATIC

Beautiful Venice, Its Dramatic Origin and Its Picturesque Situation on the Islands of the Sea—How It Rose to Opulence and Power

VENICE, ITALY. When the hordes of barbarian invaders swept over Italy in the 5th century, many of the inhabitants along the northwestern corner of the Adriatic Sea sought refuge on the low mud islands, situated some miles off the shore between the mouths of the rivers known as the Piave and the Adige. Upon this unpromising ground were laid the foundations for one of the most remarkable, one of the richest, and one of the most beautiful cities the world has ever known—Venice, the "Mistress of the Adriatic."

Venice today rests like a gorgeous seabird in a dream of silence upon its "hundred isles." No clang of traffic on noisy streets can disturb its quiet of centuries, broken only by the sound of water lapping at the foundations of ancient palaces or the romantic songs and cries of boatmen driving their black gondolas through the city's endless canals. Almost the sole intrusion of the noise of the outer world is the distant whistle of the trains as they cross the long bridge from the mainland, or the occasional chug of a motor-boat.

From the railway station the Grand Canal, describing a big letter "S" through the middle of the city to the southeast, extends to the great Doge's Palace on the Piazza of St. Mark. Just as the canal is the main thoroughfare of Venice, so the Piazza of St. Mark's, to which it leads, is the center of the city's historical and artistic interest.

The Doge's Palace, where the rulers of Venice formerly held their court, was begun in 1301, and the work of building continued for more than two centuries. The result is one of the most magnificent examples of Italian architecture and one of the most picturesque buildings of the world.

Here also, overshadowing all else on the piazza, is the world-famous Cathedral of St. Mark (San Marco), which stands immediately north of the Doge's Palace. No other building exists that can be compared to it for its amazing architectural design and its ornamentation and wealth of color. In general it has a Byzantine character, with its five great oriental domes, and resembles the former church (now mosque) of Santa Sophia at Constantinople. It is dedicated to the evangelist of the New Testament, who became the patron saint of Venice.

ON THE GRAND CANAL IN VENICE

The most striking part of Venice is the Grand Canal, which winds through this wonder city in the shape of a letter S and divides it into two nearly equal parts. The other water streets of Venice are as crooked and mixed up as the streets of London, following the windings of the deeper channels among the mud banks and islands on which the buildings stand. At the point where the canal passes out of sight in the distance you can see one end of the peaked Rialto bridge, a single marble arch 90 feet in span built in 1590. Two rows of shops divide the roadway into three narrow streets.

St. Marks as it stands today was begun in the 11th century, and all the wealth of the East was drawn upon to add to its beauty. Venetian merchants trading as far away as the Indies brought back rare stones and marbles to add to it. Columns taken from the ruins of Mohammedan temples and Byzantine basilicas are incorporated in the structure. Everywhere, inside and out, are rare mosaics. "You see nothing, you tread on nothing but what is precious," wrote an early traveler in describing St. Marks.

Over the main entrance to the cathedral are the four famous bronze horses which once stood on Nero's arch in Rome, were later carried to Constantinople by Constantine, and taken from there by the conquering Venetians in 1204. Napoleon took these horses to Paris in 1797, but they were restored to Venice after his fall. (For illustration, *see* page 1852.)

Near St. Marks is the great bell tower or campanile —now rebuilt on its former pattern—which collapsed in 1902.

The foundations of Venice rest on wooden piles driven into the mud islands of the lagoons. There are about 16,000 buildings, around and between which flow some 170 canals, crossed by more than 400 bridges. Two of these bridges are world famous—the "Rialto" and the "Bridge of Sighs." The former, which is mentioned in Shakespeare's 'Merchant of Venice', crosses the Grand Canal and is lined with shops. The latter leads from the upper story of the Doge's Palace to the state prison, where in the bygone days of Venice's power so many political offenders went to secret and cruel deaths.

Venice today has 70 churches and innumerable old palaces, each a delight to the artist and architect, for the old-time Venetians developed from their cosmopolitan experience an architecture of their own. In many respects the city is more Greek than Italian, due to its thousand years' connection with the Byzantine Empire. The libraries of Venice contain many rare manuscripts, including the early records of the city, priceless to students of history.

The harbor of Venice is separated from the sea by a long sandbank called the "Lido." It is protected from the waves by a sea-wall and has become a fashionable bathing beach. The entrance to the port is strongly fortified, and two moles stretch out into the Adriatic to prevent its filling up with the wash of sea currents.

Venice is the one part of the Roman Empire in the West which never became part of any of the old Teutonic empires. For centuries it was considered part of the Byzantine or Eastern Roman Empire, but in reality it early became a self-governing republic, under its own *doge* or duke. In the time of the Crusades Venice developed a great trade in spices, perfumes,

sugar, silks, and other goods coming from the East; and for several centuries Venice and Genoa controlled the sea routes of the Eastern Mediterranean.

The Fourth Crusade by the persuasions of the Venetians, under their blind old doge Dandolo, was turned against the Christian city of Constantinople. Its fall, in 1204, gave the Crusaders rich loot; Venice received as her share of the broken empire the Greek islands in the Aegean and Ionian seas, a portion of Constantinople itself, and the entrance to the Black Sea. Although Constantinople soon recovered its independence, the Peloponnesus of Greece and many of the Greek islands were ruled by Venice until 1718.

In the days of her power the rich merchants of Venice decided to exclude the people from any part in the government and formed an exclusive aristocracy (1296), which should elect the council and appoint the doge and have full powers in the state. Numerous revolts were put down, and the city became a close oligarchy. The cruelties of the famous Council of Ten made its tyrannical rule notorious.

Wars and Conquests

A long series of fierce wars with Genoa over the Eastern trade rights ended in 1380, when the Venetians trapped the Genoese fleet inside the Chioggia lagoons, south of the city, and forced its surrender.

A series of conquests on the Italian mainland followed, which extended Venetian territory from the River Po to the Alps, and westward almost to Milan.

The city of the doges was now at the height of its power, but a decline speedily set in. First the Turks, who had captured Constantinople in 1453, began to strip Venice little by little of her Greek possessions. In 1488 the discovery of the sea route to the Indies around the Cape of Good Hope destroyed the value of the Mediterranean routes, and brought the riches of the Orient to the Portuguese, the Dutch, and the British. Finally a combination of the Italian and European powers in the league of Cambrai wrested from Venice almost all her territory on the mainland of Italy (1508). It was during this period, however, that Venice reached her highest point of artistic development and gave to the world the famous Venetian school of painters, headed by the immortal Titian.

The last doge abdicated in 1797, to make way for the rule of Napoleon. After the fall of the latter, Venice passed into Austrian hands. Venice took a leading part in the unsuccessful revolution of 1848 against Austrian rule in Italy. It was finally given up by Austria to the new kingdom of Italy in 1866.

Venice today has again become an important trade port, thanks to the Suez Canal, which gives the city a direct route from central Europe to the East. The rich art treasures of the city, which were carried to Florence when the Austrian armies threatened to capture the city in 1917, have been brought back, and again the "Mistress of the Adriatic" attracts the travelers of the world with that fascination as deathless as the glory of its historic buildings and mysterious canals. Population, about 168,000.

VENIZELOS, ELEUTHERIOS (born 1864). "I have always told my fellow-countrymen the truth and the whole truth, and I have always been quite prepared to lay down my power without regret." This, in his own words, was the guiding principle of Venizelos, who, with all the ups and downs he experienced in his career, has been one of the most influential statesmen of modern Greece.

Of Greek ancestry, he was born near Canea in Crete, while that island was still suffering under the oppression of Turkish rule, and was given the name of Eleutherios, which means "the Deliverer." From the age of 8 to 20 he attended the lower schools and high school of Canea, where he stood out as a leader among his fellow-pupils.

When his school days were over his father expected him to go into business with him, although the youth's own desire was to study law. Greece would have lost a great statesman had it not been for the Greek consul-general at Canea, who urged the father to send his son to the University of Athens. When he returned to his native Crete as a lawyer in 1886, the desire for freedom and the ardent Greek patriotism that were in his very blood had become the ruling passions of his life. "I became a revolutionary by profession and a lawyer at intervals," he said in giving an account of his life in Crete. He became the leader of his people in the movement which finally resulted, first in liberating Crete from Turkish rule (1897–99), and later in uniting it with Greece (1912).

In 1909, when affairs in Greece were in confusion and a strong hand was needed to keep the government from going to pieces, the king appealed to him to save Greece as he had saved Crete. Venizelos, who became premier in 1910, brought about a revision of the constitution, reformed the army and navy, restored national unity, strengthened the throne, and earned the title of "the savior of Greece." He piloted the country successfully through the Balkan Wars of 1912–13, which resulted in great territorial acquisitions to the north of Greece (*see* Balkan Peninsula).

His Part in the World War

The World War of 1914–18 brought another crisis in which Venizelos was to play a decisive part. From the beginning he favored the cause of the Allies and urged King Constantine to join them. But the king, whose wife was a sister of the German Kaiser, refused to take part against Germany, even though Greece was bound by treaty to come to the aid of Serbia. Venizelos resigned, but the majority of the people were with him, and the king was forced to recall him. When Venizelos found that it was impossible to reach an agreement because of the unconstitutional conduct of the king and court party, he again resigned. Setting up a provisional government at Saloniki, he mobilized troops to aid the cause of the Allies. At last in 1917 Constantine was forced to abdicate in favor of his son Alexander. Venizelos again became premier, and was able to carry out his plans for the effective coöperation of Greece with the Allies (*see* Greece).

At the Peace Conference at Paris, Venizelos, as the principal delegate of Greece, exerted an influence out of all proportion to the country which he represented, and was able to realize his dream of uniting the scattered Greeks under the rule of the mother country. Turkey was forced to give up Thrace almost to the gates of Constantinople, together with important islands in the Aegean; a Greek protectorate was obtained over Smyrna in Asia Minor, and Italy was induced to give up the Greek Dodecanese Islands in the Aegean.

But almost in the hour of his greatest triumph there came a reaction against Venizelos. The Greek people were weary of war and confused by royalist propaganda; and when King Alexander died in December 1920, they restored the deposed King Constantine in defiance of the Allies, and overwhelmingly defeated Venizelos in the elections. Venizelos accepted the defeat with characteristic magnanimity and retired from the field of politics to await further developments, but Greece, without the support of the Allies, was unable to enforce on the reluctant Turks many of the provisions of the treaty which the genius of Venizelos had won for them.

VENUS. Originally a goddess of beauty and growth in nature, the Roman goddess Venus became identified with Aphrodite, the Greek goddess of love (*see* Aphrodite). She was represented as the highest ideal of feminine beauty. Venus was especially honored at Rome, as Romulus, the legendary founder of the city, was believed to have been descended from her son, the hero Aeneas (*see* Aeneas; Romulus).

The planet Venus, which appears so brilliant in the heavens, is named after the goddess. It is the second planet in the order of distance from the sun and the next within the earth's orbit (*see* Planets).

VENUS'S FLY-TRAP. Of all the insect-eating plants, the Venus's fly-trap is perhaps the most remarkable. This is a plant which has turned itself into a steel trap, so to speak, because it snaps shut on unwary insects in exactly the same way that a steel trap works.

The Venus's fly-trap is found only in sandy savannas near Wilmington, N.C. The leaves are in rosettes and have broad stems. Each leaf ends in two lobes that are hinged at the midrib; each lobe has spines along its margin, and its upper surface is covered with glands secreting a purplish juice. Among these glands on each lobe are three bristles, set in a triangle, each bristle hinged at the base and very sensitive. The moment an insect touches a bristle, the leaf lobes close up suddenly around it, the spines along the edges interlocking to hold the prisoner fast. The glands secrete a digestive fluid and absorb all the nitrogenous matter in the insect. It takes a leaf many days to digest one insect, and the same leaf is rarely able to digest more than two or three before it dies. Scientific name, *Dionaea muscipula*. (*See also* Pitcher Plants; Sundew.)

A NATURAL HISTORY DRAMA IN THREE ACTS

Act. 1: The blundering fly approaches the Venus's Fly-Trap, whose favorite food is an insect. **Act 2:** Snap! The lobes of the leaf have come together like the jaws of a steel trap—though not quite so rapidly—and, struggle as it may, the fly's doom is sealed. **Act 3:** The leaf settles down to the long task of digestion, which takes it several days.

VERA CRUZ (*vā'rä krụz*), MEXICO. The principal port of Mexico today, as it has been ever since Cortez landed there in 1519, is situated on the Gulf of Mexico directly east of the capital, Mexico City. Cortez named it *La Villa Rica de Vera Cruz*—"The Rich City of the True Cross"; but for centuries it was known as "the City of the Dead" because of the plagues of yellow fever and malaria which visited it. Recently, however, it has been made a clean and healthful town, with the filling in of the surrounding swamps that bred disease-carrying mosquitoes, and the construction of an excellent sewerage and water supply system. The harbor, too, which used to be dreaded by vessels because it afforded no protection from the severe "northers" which sweep the Gulf, has been improved at great cost.

The streets of the city of Vera Cruz are only a few feet above sea-level. For nearly a mile the city encircles the bay, fringed by an attractive bathing

beach; and behind it stretches a sandy dune country. The streets, though narrow, are straight and clean, lined by low buildings tinted in red, yellow, blue, and green, with here and there an important public building of recent construction. Four railways give the city access to the interior of Mexico, and one-half the foreign sea-trade of the entire country passes through its harbor. Vera Cruz is also an important manufacturing city, known especially for its cigars.

In the 17th and 18th centuries Vera Cruz was twice pillaged by privateers; their expeditions led to the construction of the celebrated Fort San Juan de Ulua on one of the little islands of the harbor. The French held the port in 1838, and again in 1861. In 1847 United States troops under Gen. Winfield Scott captured it in the Mexican War; and in 1914 American forces occupied the city owing to complications with the Huerta government which then controlled Mexico. Population, about 50,000.

VERB. Verbs are *action* words—as opposed to nouns, which are *name* words. As the noun is the important element of the subject of a sentence, so the verb is the important element of the predicate (*see* Sentence). The noun names the thing or person we are talking about; the verb asserts or predicates something about the subject. Since the verb is the most vigorous and vital part of the sentence, the part that gives life to it and converts an incomplete group of words into a sentence, the earliest grammarians called it *verbum*, which is the Latin word meaning "word." That is, the verb is *the* word, without which no grouping of the other parts of speech would make a sentence. *Dogs* and *swiftly* by themselves tell us nothing. Put in the verb *run*, and you get a complete and definite statement.

Most verbs are action verbs, but there is one very important verb that merely expresses existence and links the subject with the rest of the predicate. This is the verb *be*, with all its various forms, as in the sentence "The orange *is* yellow." Here *is* merely links the subject with the predicate adjective *yellow*. For this reason *be* and other verbs which perform a similar duty, like *become, appear, seem, remain*, etc., are called *copulative* or *linking* verbs. Such verbs are usually followed by a predicate noun, pronoun, or adjective to complete their meaning.

A verb that expresses an act involving something besides the actor is called a *transitive* verb. A verb that does not express an act involving something besides the actor is called an *intransitive* verb. In the sentence "She *stood* still," the verb *stood* expresses the act of standing, which does not involve anything besides the actor, the girl. In the sentence, "She *tore* the letter," the verb *tore* expresses an action which involves the letter as well as the actor, the girl. A transitive verb must be followed by some word or group of words which stand for the other thing involved in the act besides the actor. This word or group of words is called the *object*. In the sentence above, the word *letter* is the object.

By various changes in form, and by the help of certain other verbs called *auxiliary* ("helping") verbs, verbs are able to express many ideas in addition to their own meaning. For example, the form *am* tells us that the speaker is talking about himself; *buys* tells us that the subject is in the third person (for person, *see* Pronouns); *will go* tells us that the action is to take place in the future; *leaped* tells us that the action has already taken place. Such changes or *inflections* in the form of verbs are called *conjugation* and to conjugate a verb is to name in order all its forms.

The various ideas which may thus be expressed by merely changing the form of a verb or using an auxiliary with it are five: person, number, tense (time), mode, and voice. By *person*, it tells us whether the subject is speaking, spoken to, or spoken of. By *number*, it tells us whether the subject represents one or more than one. *Tense* tells us the time of the action. *Mode* (sometimes called *mood*) is the manner of assertion, that is, whether the action is asserted as an actual fact, as doubtful, as desired, or as commanded, etc. *Voice* is the quality that denotes whether the subject is acting or is acted upon.

Good Verbs Must Agree with Their Neighbors

A verb is said to agree in person and number with its subject. In most English verbs, however, there is only one change in form made to show change in person and number; namely, the addition of *s* to the root or simplest form of the verb to make the third person singular of the present indicative. Examples are *take, takes, find, finds*. The verb *to be* is the only one that makes more than this change to show person and number. Its present tense is as follows:

	Singular	Plural
First person:	*I am*	*We are*
Second person:	*You are*	*You are*
Third person:	*He, she, or it is*	*They are*

In the past tense this verb has two forms: *was*, singular, and *were*, plural. But *you were* is used for both singular and plural.

In English the verb has six tenses: *present*—denoting action going on in the present (I *write* or *am writing*); *past*, denoting action in the past (I *wrote* or *was writing*); *future*, denoting action about to take place (I *shall go*); *present perfect*, denoting action completed or perfected just before the present (I *have spoken*); *past perfect*, denoting action completed in the past (I *had gone*); *future perfect*—denoting action that will have been completed at some future time (I *shall have gone*).

To show the attitude of the speaker toward his assertion there are three modes. The *indicative* mode is used to state something as a fact; the *imperative* mode is used to express a command or an entreaty; the *subjunctive* mode is used to express something as wished, possible, or merely thought of. In English the indicative, imperative, and subjunctive forms are for the most part alike. The subjunctive mode omits the ending *s*, "Long *live* the king!" The verb *to be*, however, has the subjunctive form *be* for all persons and numbers in the present tense, and the form *were*

for all persons and numbers in the past tense. Familiar examples are: "if it *be* I" and "if I *were* you." The subjunctive mode of the verb is little used in spoken English today. Instead we commonly use phrases formed with certain auxiliary verbs; as *may rain, might have rained,* if it *should rain.*

Difference between Acting and Being Acted Upon

A verb that represents its subject as acting is said to be in the active voice; as "I *tore* the letter." One that represents its subject as being acted upon is said to be in the passive voice; as, "The letter *was* torn." The passive forms are made by combining the six tenses of the verb *to be* with the past participle of the verb conjugated; as, I *am attacked* (present); I *was attacked* (past), etc.

In addition to the various forms of the verb which we have discussed, there are two others that are usually called *verbals,* though they are sometimes classed as modes. These forms are the *infinitive* and the *participle.* They are verb forms in that they both may take an object, and the infinitive may take a subject as well; but they resemble nouns, adjectives, and adverbs, in that they cannot of themselves form a predicate. In general, they are equivalent to condensed clauses and may be used, like clauses, with the functions of an adjective, an adverb, or a noun; for example, *To err* is human (infinitive used as a noun); He came *to see* me (infinitive used as an adverb); *Seeing* is *believing* (participle used as a noun); *Fearing* detection, he fled (participle used as an adverb); the *blushing* rose (participle used as an adjective). Both infinitives and participles have voice and tense, but neither person nor number. The participle occurs in the present, past, and perfect tenses; the infinitive in only the present and perfect.

Regularity and Irregularity among Verbs

According to the way they form their past indicative and past participle, verbs are classified as *regular* and *irregular* or *weak* and *strong.* A verb that forms its past tense and past participle by the addition of *ed, d,* or *t* is of the regular or weak conjugation. This conjugation includes by far the greater number of English verbs. Examples are: *lay, laid, laid; keep, kept, kept; walk, walked, walked.* To the weak conjugation also belong all verbs whose forms are alike throughout; as *set, set, set.* Verbs that do not add a *d* or *t* sound to form the past tense and past participle are generally of the irregular or strong conjugation; as *see, saw, seen; do, did, done; fight, fought, fought.* Strong verbs generally change the root vowel in the past tense; but many weak verbs also change. The verb *to be* is irregular, formed from three different roots; its forms are *be, am, is, are, was, were, being, been.* A few verbs used as auxiliaries are defective, which means that they are used in only one or two forms; as, *ought, must, will.*

Some of the commonest errors in the use of verbs are illustrated in the following sentences:

Lack of agreement between subject and verb—"We *was* there" for "We *were* there."

Misuse of the present for the past—"I *come* here a year ago" for "I *came* here a year ago"; "I *give* him a quarter yesterday" for "I *gave* him a quarter yesterday."

Confusion between the participle and the past tense—"I *seen* it" for "I *saw* it"; "I have *went*" for "I have *gone*"; "I have *wrote*" for "I have *written.*"

Incorrect formation of tense—"I *knowed* the lesson" for "I *knew* the lesson"; "He *et* the apple" for "He *ate* the apple."

Confusion between verbs similar in meaning—"We *laid* down on the beach" for "We *lay* down on the beach"; "Please *set* down" for "Please *sit* down"; "That *learned* me a lesson" for "That *taught* me a lesson."

VERDI (*vĕr'dē*), GIUSEPPE (1813–1901). Everyone knows the "Anvil Chorus" from 'Il Trovatore' of Verdi. Probably no opera score has furnished more popular numbers than this chorus and the melodic "Ah, I have sighed to rest me," from the same composition. The man who wrote these and countless other world-famous tunes was born in a little village in Italy, in the valley of the River Po, not far from Parma. At ten years of age he became organist in the village church. Later he studied music in Milan, and in 1838, having married, he took up his residence there. A period of struggle followed, and just as Verdi had established a reputation and realized the first financial benefits from his compositions, his wife and two children died within a few weeks of one another. Some time elapsed before Verdi's next opera was brought out, but extraordinary success crowned its production. With 'Ernani', in 1844, his fame and fortune were secure. Soon after this time, the right to publish one opera brought him $4,000. Later, in the case of his opera 'Aïda', he received $20,000 for his first night's performance.

Verdi's last opera, 'Falstaff', was produced just before his 80th birthday. Thousands of music lovers journeyed to Milan from all parts of Italy for its first performance, and the ovation the old composer received has scarcely been equaled in musical history.

Of his 30 operas, 'Rigoletto' and 'Il Trovatore' are most widely known; but his 'Aïda', 'Otello', and 'Falstaff' possess a much greater degree of musicianship and show the influence of Wagner. Of his church music, the 'Manzoni Requiem' and 'Stabat Mater' express in the highest degree the imaginative power and musical genius of the composer.

VERDUN (*vĕr-dŭn'*), FRANCE. When the German armies swept over Belgium and into France in August and September 1914, all the great fortified cities in their path fell quickly before their heavy guns—all except Verdun on the Meuse River, 23 miles south of the Franco-Belgian frontier and about the same distance west of the border of Alsace-Lorraine, which in those days belonged to Germany.

Here the invaders' lines were halted and bent into a great inverted U, whose two prongs reached southward more than 20 miles on each side of Verdun. Even after the German armies to the west had been stopped and thrown back in the Battle of the Marne, the German Crown Prince drove in a wedge east of the city and on September 12 captured St. Mihiel—

a strong position which was held by the enemy until United States troops recaptured it, four years later to the day. But in spite of this wedge the French defenders held their ground with stubborn courage was soon to send a thrill of pride through the heart of every Frenchman and fix the eyes of the entire world on those bloody hills above the Meuse. "They shall not pass!" said Pétain. "They shall not pass!" repeated every shivering *poilu*.

A year and five months passed. Then the German general staff, confident of its mastery on the eastern front, determined upon a crushing blow at France before Great Britain's newly trained armies could take the field.

The spot chosen was Verdun, because it was like a spear-head thrust in the side of the German battle-line, a constant menace and a constant challenge. The Crown Prince was put in command under the guidance of strong advisers. An unheard-of number of guns was concentrated upon the French trenches which defended the slopes of the Verdun plateau. A quarter of a million Germans were massed for the attack.

VERDUN—"THEY SHALL NOT PASS!"

Hundreds of thousands of lives were sacrificed by the Germans in 1916 in their vain endeavor to take this historic city, which was long the farthest outpost of the French on the northeast front. A glance at almost any building will show shell-holes and other damage caused during the terrific fighting.

On Feb. 21, 1916, the storm broke. A torrent of shells poured upon the French positions, blotting out the first and second lines of defense. Clumps of trees which sheltered French artillery were wiped out of existence in a few minutes. The ground was ripped and torn as if by an earthquake. Then through the heavy fog the famous German "shock troops" advanced to the charge. The French who had survived that hail of metal fought stubbornly and went down. Moving forward with caution and mechanical regularity, the Germans took line after line. In four days they had advanced four miles, reaching the first of the outlying forts which encircled Verdun. All day on February 25 the attackers, wave upon wave, surged up the snow-covered slope of Douaumont Hill, only to break and melt away under the murderous fire of French machine guns and shrapnel. Then towards evening, while Emperor William himself looked on from a distant hill, the crack 24th Regiment of Brandenburgers went forward in a supreme assault and carried the crest.

At this juncture arrived Gen. Philippe Pétain, and that night there was whispered down the weary and broken lines of troops the magic watchword which

The next morning the French in an impetuous charge drove the Germans back from Douaumont Hill. For four days the battle raged, until, on March 1, the attack subsided.

The second phase of the struggle opened on March 2 with an attack of redoubled fury on the French positions west of the Meuse. For six weeks munitions and lives were recklessly and vainly thrown away in an effort to take Dead Man's Hill, which on this side was the key to Verdun. Then, after a month of rest, the Germans opened a third desperate attack from all sides at once. This time Dead Man's Hill was taken as well as Fort Douaumont and Fort Vaux. Throughout the month of June the struggle raged.

But still Verdun held fast. By July 1 the battle there had virtually come to an end, and the German General Staff was compelled to turn its attention to the north, where the British were launching their first great drive on the Somme River.

The effort to take Verdun cost the Germans about 300,000 men in killed, wounded, and prisoners, and all they gained were two demolished forts and the ruins of a few surrounding villages. On the other hand, the effect of the successful defense of this historic city on the spirit of the French and British was of immense and immediate value. They felt that Germany had delivered the hardest blow it was capable of, and that this best was not good enough to win.

Verdun is a very old city, dating back to Roman days. Perhaps the most significant event in its earlier history was the treaty signed there in 843 between the sons of Louis the Pious, dividing up the former empire of Charlemagne. Out of this territorial division grew the countries of France and Germany, and their age-long rivalries over the "middle strip" which included Lorraine, which were one of the factors in the great World War itself. Population, about 20,000.

VERGIL (70–19 B.C.). The greatest of the Roman poets, and the one who gave supreme literary expression to the highest qualities of Roman genius, Publius Vergilius Maro was not a Roman by birth. His early home was on his father's farm in the village of Andes near Mantua in what was then the province of Cisalpine Gaul. His father was a small freeholder, who farmed his own land and prospered sufficiently to give his son the best education that the times provided. The young Vergil was sent to school at the neighboring town of Cremona and then to Milan. At the age of 17 he went to Rome, where he studied rhetoric and philosophy under the best masters of the day.

After the Civil War between Caesar and Pompey, which put an end to republicanism in Rome, Vergil's farm was among the estates confiscated. The loss, however, proved to be a blessing in disguise, for it brought him powerful friends who obtained another estate for him and introduced him into the intimate circle about Octavian, soon to become the Emperor Augustus. Chief of his friends and patrons was Maecenas, the great Home Minister of Augustus, and through his liberality Vergil was relieved of all material cares and was thus enabled to devote himself entirely to literature.

In the quiet years that he spent in the country he read and studied the Greek poets. Following Theocritus as a model, he wrote his 'Eclogues', pastoral poems in which he gave expression to his tender feelings for the beauty of Italian scenes. At the suggestion of Maecenas he wrote a more serious and original work on the art of farming and the charms of country life, the 'Georgics', which established his fame as the foremost poet of his age. The year after they were published, he began his great epic, 'The Aeneid', taking as his hero the Trojan Aeneas, supposed to be the founder of the Latin nation, and thus celebrating the glory of Rome and the imperial family. He had devoted more than ten years to this work when, on a visit to Greece, he contracted a fever which proved fatal. On his deathbed he begged that the 'Aeneid' should be destroyed, saying that it still wanted three years' work to bring it to perfection. The command of Augustus alone prevented the carrying out of the poet's request and saved for the world one of its epic masterpieces.

The poem, published after Vergil's death, exercised a tremendous influence upon Latin literature, prose as well as poetry. Even the Christian church regarded him as divinely inspired, and thus his influence continued through the Middle Ages and into modern times. Dante revered him as his master and represented him as his guide in the 'Divine Comedy'. Chaucer, Spenser, Milton, and Tennyson owed much to him. The superstitious people of medieval times looked upon his tomb at Naples with religious veneration, and many stories arose which endowed Vergil with magical powers.

The "GREEN MOUNTAIN STATE" *and its Rock-Ribbed Hills*

VERMONT. "The Green Mountain State" is a government formed by revolt; but its revolt was not against England, as was that of the Thirteen Colonies, but against those colonies themselves. Vermont's declaration of independence, dated Jan. 16, 1777, was directed especially against New York and New Hampshire, both of which colonies claimed this district; and the celebrated "Green Mountain Boys" who performed one of the great feats of the Revolution in taking Fort Ticonderoga (May 10, 1775) were originally organized to resist the writ-servers from New York.

Extent.—North to south, 158 miles; east to west, greatest width, 90 miles; area, 9,564 square miles. Population (1920 census), 352,428.

Physical Features.—Mountain-ridged uplands with many deep valleys and small lakes and ponds. Principal ranges: Green Mountains (highest point, Mount Mansfield, over 4,360 feet), and Taconic. Principal rivers: Missisquoi, Lamoille, Winoosky, and Otter, draining into Lake Champlain on the western border; White, Passumpsic, and West, draining into the Connecticut River which forms the eastern boundary.

Products.—Hay, potatoes, oats, fruit, maple sugar and syrup; cattle and dairy products, horses, sheep and wool; granite, marble, slate, talc, soapstone, lime; paper, wood pulp, lumber, wooden ware, machinery, woolen and cotton goods, flour, and farm implements.

Chief Cities.—Burlington (23,000), Rutland (15,000), Barre, and Montpelier (capital).

Until 1749 Vermont was generally known as "the wilderness." Although its lakes, rivers, and mountain passes were used by the French and Indians coming down from Canada to attack the British and by the British going up to make their reprisals, peaceful settlement was not attempted until that year. The governor of New Hampshire then took advantage of his colony's claims to "the wilderness" to issue land grants to settlers, and numerous small settlements sprang up under the name of "the New Hampshire grants." But in 1764 the British crown issued an order declaring the Connecticut River the boundary between New York and New Hampshire. The settlers then found themselves obliged to repurchase their lands from the New York authorities or lose them. They took up arms to assert their rights under the leadership of Ethan Allan, Seth Warner, and Remember Baker, and in 1771 organized the military force known as the "Green Mountain Boys."

Vermont was not one of the colonies to sign the Declaration of Independence, for its existence as a separate government was not recognized at that time. In 1777 it declared itself an independent state and asked for admission under the name of "New Connecticut." Dr. Thomas Young of Philadelphia suggested "Vermont" (from the French words for "green" and "mountains") as more appropriate; and in June this name was adopted, together with a state constitution, based upon the one then in force in Dr. Young's state of Pennsylvania.

THESE BRING FAME AND FORTUNE TO VERMONT

Hay, butter, and cheese are the principal products of Vermont's farms. Fruits are also important, especially apples and pears, in the Lake Champlain region. The forests provide timber of many species, of which the syrup-yielding maple is probably the most highly valued. Genuine Vermont maple syrup and maple sugar are as popular today as they were a century ago. But not only the farms and forests keep Vermont busy, for the rocks of the state include two of the most valuable for building purposes—granite and marble. This native stone is used with excellent architectural effect in the dignified Capitol at Montpelier and in some of the buildings of the University of Vermont, which was chartered in 1791 and opened in 1800.

contained in the Easy Reference Fact-Index at the end of this work

THE LARGEST BLOCK OF GRANITE EVER QUARRIED

More than 300 men are sitting or standing on this huge block of stone, the largest single block of granite ever quarried. When it was broken up, 1700 flat cars were required to distribute the pieces to various manufacturing plants. The granite quarries are widely scattered in the eastern part of Vermont, all of the granite being obtained east of the Green Mountains. Barre is considered the greatest granite center in the world.

But New York as a state had not given up its claims gained while a British province, and for 14 years more Vermont was treated by the Continental Congress as a district of New York. During this time Vermont issued copper coins bearing the words "Republic of the Green Mountains," and maintained itself and its constitution. In the end Vermont entered the Union (March 4, 1791) with the consent of both New York and New Hampshire, on the payment of $30,000 in settlement of the outstanding land claims.

Why the East and West Roads are Bad

Long and narrow, crumpled and deeply seamed, Vermont lies wedged between the Connecticut River, its eastern boundary, and Lake Champlain, its boundary for more than half its length on the west. (For Map *see* New Hampshire.) Down from the north come the forest-robed Green Mountains in double file, to unite near the middle of the state and continue their march into Massachusetts as a single range. They split Vermont into eastern and western halves so effectively that, excellent as are Vermont roads in general, it is difficult to find a passable road from east to west; and they dominate the landscape so completely that there are few places in the state where they cannot be seen. To the west the Red Sandrock Hills and the Taconics, and to the east the Granite Hills, all rounded by glacial action, with many little lakes and streams and deep-cut valleys scattered in between, lend variety and beauty to the surface.

Equally varied are the agricultural soils. There is much rocky unproductive land, and many excellent farms, the crop average per acre being high. Hay is the most valuable single crop, and this, together with convenient access to the large markets of Boston and New York, naturally leads Vermont farmers to specialize on dairy products. Potatoes also are extensively raised. Large crops of fruit, apples and pears predominating, are raised, particularly in the vicinity of Lake Champlain. Maple sugar, which the Indians taught the first white settlers to make, is an important crop, and the Vermont product stands high for quality as well as for quantity.

Vermont winters are long and cold; there may be good sleighing for three months at a time. The summers are warm but seldom hot.

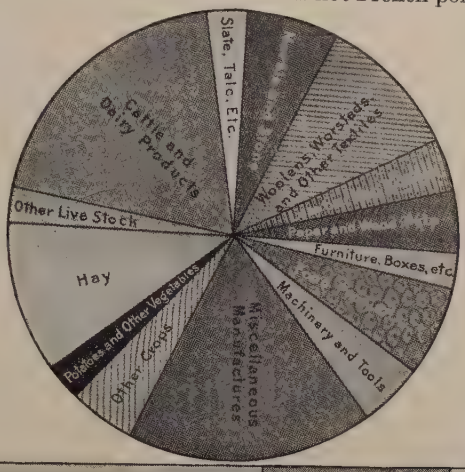
The forested mountain slopes furnish a large amount of lumber. The woods include spruce and other conifers from near the mountain tops, and birch, beech, maple, and other deciduous trees from the lower slope. The state forestry department controls directly 11 state forests, with a combined area of nearly 10,000 acres, and other forests indirectly.

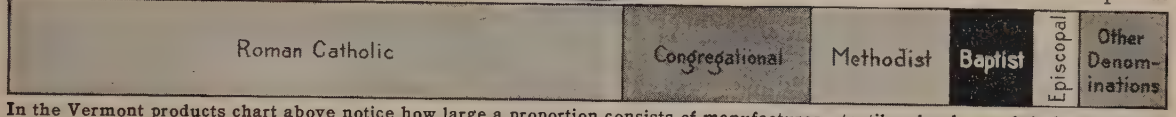
Vermont's Famous Marbles and Granites

From the rock-ribbed mountains come the state's most distinctive products, its marble and granite. All the marble is quarried west of the Green Mountains (chiefly in the region centering about Rutland), and all the granite in the east. The famous Rutland

marble is a very pure lime carbonate of almost endless variety, ranging from fine white to almost black. A single quarry may furnish more than 20 varieties, all fine, with veins, clouds, and blotches of blue, pink, yellow, gray, and black; more than 100 shades are obtainable. For many years Vermont supplied at least four-fifths of the marble used in the United States, and the Vermont quarries are still among the world's leading producers.

The granite quarries are more numerous and scattered than the marble quarries. Besides Barre, which is one of the greatest granite centers in the United States, Hardwick, Woodbury, Bethel, and many smaller places produce important amounts of granite. Most Vermont granite is gray; the famous "Windsor green granite" comes from Mount Ascutney, in Windsor County. Vermont is a leading state also in the production of slate and talc. Kaolin, ochre, and fire clay are among the other mineral products.





In the Vermont products chart above notice how large a proportion consists of manufactures—textiles, lumber and timber products, food products, machinery and tools, and miscellaneous manufactures. The religious divisions of the population are shown below.

Though small in size and almost stationary in population for several decades, the state has been great in influence. Vermont has produced many able men, and has the habit of sending to Congress representatives of weight and caliber. So many of its young people has the state contributed to the building up of the newer section of the country for nearly a century that associations of "native Vermonters" exist in almost all the larger cities of the United States, while hundreds of abandoned Vermont farms are reverting to wilderness. The quarries and factories have of late years attracted many Canadians and others from outside the United States; about 35 per cent of the population are foreign born or of foreign parentage, representing more than 20 different nationalities.

Vermont's vacation attractions equal and perhaps surpass those of New Hampshire, but as yet the Green Mountains, the nearly 400 lakes and ponds (excepting lakes Champlain and Memphremagog), and the streams adaptable to the purposes of the vacation fisherman have been little exploited by the tourist.

Burlington, the chief city, has been built up mainly by the lumbering industry, though it has many other manufacturing interests and a large lake commerce, while near by are large marble and limestone quarries. It is the seat of the University of Vermont. Rutland, on Lake Champlain, and Montpelier, the capital, also have many industrial establishments.

VERSAILLES (*vĕr-sā'ye*), FRANCE. On Jan. 18, 1871, the throne room of the great palace at Versailles, the palace built by the magnificent Louis XIV, two miles from Paris, was aglow with pomp and ceremony. But it was not French pomp, and if the old walls had had a tongue they would have cried out against the spectacle. For the Prussian conquerors of France were there proclaiming in the heart of the vanquished nation that King William of Prussia was henceforth to be emperor of a new-founded German Empire.

Forty-eight years later, almost to a day, the statesmen of 27 allied countries sat in this same palace at Versailles. The German Empire, with its military power and arrogance, was crushed, and the Allied statesmen were discussing what terms of peace and reparation should be imposed.

There was something singularly appropriate in the choice of the palace at Versailles for the scene of the Paris Peace Conference, which was to end the World War of 1914–18, and give birth to the League of Nations. This palace is one of the most magnificent in the world. In building it, Louis XIV spent money as lavishly as any king in European history. Yet even he was so appalled by the cost that he destroyed all the accounts, so his people should never know the full extent of his extravagance. It has so many rooms that it takes several hours just to walk through them all, and they are filled with works of art that alone cost millions of dollars. The palace is more than a quarter of a mile long. The Battle Gallery, an immense room 400 feet long, is lined with paintings representing famous French victories and busts of patriot heroes. Near by Louis XIV built a smaller palace called the Trianon; and later his great-grandson, Louis XV, had a still smaller one called the Little Trianon built, in which Marie Antoinette lived and played at being a dairy maid.

The great palace is surrounded by a wonderful park with terraces, a big lagoon, beautiful woods, and many fountains. In the glassed-in orangery are 1,200 orange trees, some of which are said to be 500 years old.

Versailles palace has a special interest for Americans because here on Nov. 30, 1782, was signed the preliminary treaty of peace between Great Britain and the United States which recognized the independence of the United States.

The town of Versailles is of little interest outside of the palace. Population, about 60,000.

VERTEBRATES. Animals with backbones, including the most highly developed creatures—fishes, reptiles, birds, and mammals—are called vertebrates. They differ from the invertebrates or "backbone-less" animals in many other ways. The jointed hollow backbone and its upper extension, the bony brain-box or cranium, together form a protecting case for the central nervous system. Vertebrates have, typically a head, four limbs, a trunk, and a tail—though snakes have lost all their limbs, whales have lost two, and the higher apes and human beings have lost their tails. Almost all young vertebrates have "gill-slits," showing racial development from a water-inhabiting ancestry. Fishes and some amphibians breath through these gill-slits throughout life; but in most amphibians (frogs, for instance) the gill-slits close and disappear when the baby tadpole grows up. In the higher vertebrates the slits disappear before the animals are hatched or born.

Most important of all is the supporting rod in the back. In the simpler forms of vertebrate this is called the "notochord," and is simply a rod of gristle, extending along the back; in the higher forms it is replaced, in the adult, by the backbone. Some animals provided with a notochord either never develop a backbone or lose it by degeneration when they grow up; yet they are very closely related to the backboned animals. Therefore, late schemes of classification tend to replace the group name *Vertebrata* by the name *Chordata*. (*See* Animal Kingdom.)

VESPUCIUS (*vĕs-pū'shŭs*), AMERICUS (1451–1512). In a geography printed in the year 1507, a German professor named Waldseemüller said: "Another fourth part of the globe has been discovered by Americus Vespucius. So I do not see why anyone should rightly object to calling it 'America', after its discoverer Americus."

Waldseemüller had probably never heard of Columbus. His suggestion, taken up by the early map makers, resulted in one of the greatest injustices in history—the naming of the New World after an unimportant Florentine merchant and navigator who accompanied several Spanish or Portuguese expeditions to South America and wrote about them, instead of after its real discoverer, Christopher Columbus.

Americus Vespucius (or Amerigo Vespucci, as the name is in Italian) was in Spain at the time of Columbus' first and second voyages. In a Latin letter, printed in 1504, he claimed to have made four voyages, on the first of which (1497) he explored the South American coast. This would make him the first discoverer of the American continent, for at that time Columbus had only reached the outlying islands.

But we have only Vespucius' word for this voyage, and scholars generally reject it. Vespucius did accompany an important Spanish expedition—that of Ojeda—to South America; and in 1501 and 1503 he went with Portuguese expeditions to the New World. But he seems never to have commanded an expedition himself, and was in no sense the "discoverer" of the continents to which his name is given.

VESTA. The hearth, in ancient times, was the center of family life. It was the place where the meals were prepared, the family gathered; above all, it was the place where sacrifices were offered to the gods, so that it came to be regarded as a sacred altar.

VESTAL VIRGINS LEARNING THEIR SACRED DUTIES

The chief duty of the Vestal Virgins of ancient Rome was to keep the sacred fire burning in the Temple of Vesta. They also brought water from a sacred spring to be used in the ceremonial sweeping and sprinkling of the shrine, to offer sacrifice and libations, to guard the sacred objects, and to offer daily prayers for the state. They lived in great splendor in a magnificent mansion, with public slaves to wait on them, and occupied the best seats at theaters and other places of amusement.

The Romans worshipped Vesta as the goddess of the hearth and the guardian of family life, and a beautiful temple in the Forum was dedicated to her service. Here the ever-burning sacred fire was guarded by priestesses called "vestal virgins," at first four but afterward six in number. They were from six to ten years old when chosen, and spent 30 years in the service—the first ten in learning their duties, the second ten in performing their services as priestesses, and the last ten in teaching the new virgins. Thus there was a total of 18 maidens, of whom only six were actively performing the duties of Vestal Virgins. They were bound by vows to remain chaste and pure, and to protect the sacred fire even in time of danger; for to allow it to be extinguished would, it was believed, bring disaster upon Rome. If a Vestal violated her vow, she was stoned to death or buried alive.

On the first day of March, the Roman New Year's Day, the sacred fire was renewed. The chief festival in honor of Vesta was celebrated in June. In private houses the feast was kept by eating a meal of fish, bread, and herbs before the hearth and the images of the *Lares* and *Penates*, or household gods.

In much the same way the Greeks worshipped the goddess Hestia, and in her honor a sacred fire was kept constantly burning in the *prytaneum* or assembly hall of every state.

VESUVIUS IN ERUPTION

No, volcanoes do not smoke, as you might suppose. These dark clouds are composed of steam and other gases mingled with dust and ashes thrown out of the volcano's mouth. This black column reached a height of thousands of feet during the eruption of Vesuvius in 1906.

VESUVIUS, MOUNT. Across the beautiful Bay of Naples, less than ten miles from the city of Naples, stands the famous volcano of Vesuvius. A cloud of dust and steam eternally wreathes its summit, for Vesuvius never slumbers; and the dwellers at its foot cast many an anxious glance at its menacing bulk whenever the cloud seems blacker and denser than usual. Vesuvius has taken a heavy toll of life and property through the centuries since daring men first settled in its shadow, and no man knows when other villages will share the fate that overwhelmed the buried cities of Pompeii and Herculaneum over 1,800 years ago.

One of the most destructive of recent eruptions took place in April 1906. For a week Vesuvius had been ominously quiet, sending forth from its crater only a sluggish stream of lava and little puffs of steam. Yet the instruments in the observatory half-way up its side showed that internal agitations were going on. Presently the steam cloud increased in volume, and masses of red-hot rocks and ashes shot up to the height of a mile or more, mingled with the steam.

The eruption increased spasmodically. Great bowlders could be seen rising and falling in the mighty jet of steam and spearlike shafts of fire. Suddenly heavy explosions tore open the whole mountain side and made new vents for the streams of lava which bathed the volcano from base to summit in a bright red glow. The fiery fountain bursting from the crater seemed to lose all trace of steam and to be composed wholly of incandescent light.

The entire mountain was now a huge boiler, humming and palpitating with internal pressure. From time to time there came staggering shocks of earthquake. At last came the crisis, when portions of the rim were blown away, the center was cored out to a great diameter, and the height reduced 300 yards on the northeast side. Alongside the vertical column of fire, a side jet of thousands of tons of cinders and small stones shot out over the villages below.

For a week the shower of sand was almost constant, and as the black eruption cloud kept rolling down on the valley, the darkness was unbroken. When the cloud at last cleared, there was devastation everywhere. Once more Vesuvius had reaped its harvest of lives.

Mount Vesuvius is about 30 miles in circumference at the base. The height varies several hundred feet from time to time, according to the effects of successive eruptions, but it averages 4,000 feet above sea level. The mountain has two summits. The lower, called Somma, half encircles Vesuvius proper, the present active cone. The top of Vesuvius is cut off or truncated and is about 2,000 feet across.

The region about the volcano has been densely populated for more than 20 centuries. The great eruption of Aug. 24, 79 A.D., which destroyed Pompeii and Herculaneum, was the first one in historic times (*see* Pompeii). During the next 1,500 years there were occasional eruptions, but none of equal magnitude.

In 1631 another violent eruption destroyed 18,000 lives. Since that time Vesuvius has never been entirely quiet, and in the last century the eruptions have increased in frequency.

An electric railway carries passengers from Naples to the foot of the cone, and a wire rope railway leads from there to within 150 yards of the mouth.

VETO. "I forbid" was the formula used by a Roman official when he disapproved of laws passed by the senate. Only, as he spoke Latin rather than English, he said *veto* or *interdico*, which means the same as "forbid" or "prohibit." We have kept the first word, *veto*, to mean the power to object to an act of the legislature, and in some degree to prevent its taking effect.

Since the days of the Roman Republic most nations have given some form of the veto to their executives. Most of the kings of Europe had the *absolute* veto—that is, a law which they had forbidden could not go into force. The king of England once had such a right, but the power has never been used since 1707. When the people of France revolted against the old absolute monarchy, in 1789, some of them wished to take from the king entirely the veto power. Finally he was left with a *suspensive* veto; that is, if the same law was passed three times by the legislature, he might veto it twice, but the third time it went into force in spite of his disapproval.

The president of the United States similarly has a *limited* veto. He may refuse to sign a bill passed by Congress and return it to that body with a statement of the reasons for his refusal. This statement is called his veto. If, after this, two-thirds of each house vote that the bill shall become a law, it is passed over his veto—that is, it becomes a law in spite of his disapproval. The president has the right to keep a bill ten days before he signs it or returns it to Congress. If Congress adjourns before the ten days are passed, any bills that the president has are killed by the "pocket veto"; that is, the president prevents the law going into effect by doing nothing with it. This is a power which has been extensively used since the days of Jackson. (*See* President of the United States.)

VICE-PRESIDENT OF THE UNITED STATES. The Constitution of the United States provides that in case the president dies or becomes disqualified for holding office, he shall be succeeded by the vice-president. This has occurred five times in the history of the country. Because he may be called upon to act as president, the qualifications for vice-president are the same as those for president (*see* President of

THE VICE-PRESIDENTS OF THE UNITED STATES

Name	Term	State	Party	President
1. John Adams	1789–1797	Massachusetts	Federalist	George Washington
2. Thomas Jefferson	1797–1801	Virginia	Democratic-Republican	John Adams
3. Aaron Burr	1801–1805	New York	Democratic-Republican	Thomas Jefferson
4. George Clinton†	1805–1809	New York	Democratic-Republican	Thomas Jefferson
	1809–1812			James Madison
5. Elbridge Gerry†	1813–1814	Massachusetts	Democratic-Republican	James Madison
6. Daniel Tompkins	1817–1825	New York	Democratic-Republican	James Monroe
7. John C. Calhoun	1825–1829	South Carolina	Democratic-Republican	John Quincy Adams
	1829–1832			Andrew Jackson
8. Martin Van Buren	1833–1837	New York	Democrat	Andrew Jackson
9. Richard M. Johnson	1837–1841	Kentucky	Democrat	Martin Van Buren
10. John Tyler	1841–1841	Virginia	Democrat	William Henry Harrison
11. George M. Dallas	1845–1849	Pennsylvania	Democrat	James K. Polk
12. Millard Fillmore*	1849–1850	New York	Whig	Zachary Taylor
13. William R. King†	1853–1853	Alabama	Democrat	Franklin Pierce
14. John C. Breckenridge	1857–1861	Kentucky	Democrat	James Buchanan
15. Hannibal Hamlin	1861–1865	Maine	Republican	Abraham Lincoln
16. Andrew Johnson*	1865–1865	Tennessee	Republican	Abraham Lincoln
17. Schuyler Colfax	1869–1873	Indiana	Republican	Ulysses S. Grant
18. Henry Wilson†	1873–1875	Massachusetts	Republican	Ulysses S. Grant
19. William A. Wheeler	1877–1881	New York	Republican	Rutherford B. Hayes
20. Chester A. Arthur*	1881–1881	New York	Republican	James A. Garfield
21. Thomas A. Hendricks†	1885–1885	Indiana	Democrat	Grover Cleveland
22. Levi P. Morton	1889–1893	New York	Republican	Benjamin Harrison
23. Adlai E. Stevenson	1893–1897	Illinois	Democrat	Grover Cleveland
24. Garret A. Hobart†	1897–1899	New Jersey	Republican	William McKinley
25. Theodore Roosevelt*	1901–1901	New York	Republican	William McKinley
26. Charles W. Fairbanks	1905–1909	Indiana	Republican	Theodore Roosevelt
27. James S. Sherman†	1909–1912	New York	Republican	William H. Taft
28. Thomas R. Marshall	1913–1921	Indiana	Democrat	Woodrow Wilson
29. Calvin Coolidge*	1921 1923	Massachusetts	Republican	Warren G. Harding

*Succeeded to Presidency
†Died in office

the United States). He is elected at the same time and in the same manner as the president. His term is for four years.

Originally, there were no candidates for this office as there are now, but the man receiving the second largest number of votes for president became vice-president. In 1801 Jefferson and Burr each received 73 electoral votes and the House of Representatives had to decide between the two candidates. After 36 ballots, Jefferson obtained a majority, and Burr became vice-president. This contest aroused intense excitement all over the country, and the earnest opposition of Alexander Hamilton to Burr was one of the chief causes of the famous quarrel between the two men, terminating in a duel in which Hamilton was killed. To prevent another such bitter contest, the 12th amendment was adopted, providing for separate ballots for the two offices in the electoral college.

The vice-president's sole duty is to preside over the Senate. Even in that position he has little influence. He casts the deciding vote in case of a tie, but as presiding officer he is hedged in with rules to prevent him from influencing the deliberations. In case the vice-president dies or becomes president, the Senate selects one of its own members to preside.

This unimportance of the vice-presidency is a serious weakness in the governmental machinery. Since any congressman or senator can be far more influential than the vice-president, there is little in the office to attract men of outstanding ability, and the nomination usually goes to the "favorite son" of some doubtful section to secure its political support for the ticket. The result is that the vice-president is often poorly qualified to become chief executive.

VICKSBURG, BATTLE OF. On Jan. 29, 1863, General Grant was put in command of the Army of the West with the orders to capture Vicksburg, the last important place held by the Confederates on the Mississippi, and the only point at which they could keep up communication with the states to the southwest. To sever this connection it was necessary to capture the city. Lincoln was eager for a victory for another reason also. There was great discouragement at the North; a draft had been necessary to raise men for the army; the party demanding peace at any price was increasing, and the elections of 1862 had gone against the party which favored continuing the war.

Under these circumstances a victory for the Union forces was necessary; but it was a hard task that was allotted to General Grant. Vicksburg is located on a high bluff on the east bank of the Mississippi, but the land approaching it is marshy and difficult to cross. In spite of the almost insurmountable obstacles Grant set determinedly to work. For weeks his men fought desperately, with pick and shovel rather than with guns, digging a canal across the neck of land opposite to Vicksburg. They hoped by this means to turn the Mississippi from its old bed and so gain access to the city. In this conflict with the "Father of Waters" they were defeated. Another way had therefore to be sought to reach the city. There was only one place where this could be found, and that was to the south.

The west bank of the Mississippi was now dry enough for the men to traverse, but how were they to recross to the east bank after getting below the city? This could be done in only one way: The fleet must brave the Confederate batteries and go down the stream as the men marched along the west shore. One dark night the attempt was made. The Confederates learned of the plan, and sent some of their men across the river in skiffs to set fire to houses on the opposite shore, in order that Confederate gunners might have light to see the Union ships. Nevertheless all but one of the Union's vessels ran by the batteries in safety, and, once below, they quickly carried Grant's men across to the eastern bank.

Seven Battles and Seven Weeks of Siege

This was all accomplished by the last of April 1863. Now began the task of pushing the Confederates back into the city. Seven times Grant met and defeated the troops of the enemy, before he finally reached Vicksburg. Failing in an attempt to take the town by storm, he settled down to starve it into surrender. For seven weeks the Confederates held out. During all that time they were cut off from communication and supplies with the outside world. In addition to the hardships due to lack of food, the city was constantly being shelled by the Federal batteries.

A Confederate lady who was shut up in the city gives this description of life during that trying time: "So constantly dropped the shells around the city that the inhabitants all made preparations to live under the ground during the siege. We seized the opportunity one evening when the gunners were probably at their supper, for we had a few moments of quiet, to go over and take possession of our cave. Our dining, breakfasting, and supper hours were quite irregular. When the shells were falling fast, the servants came in for safety, and our meals waited for completion some little time; again they would fall slowly with the lapse of many minutes between, and out would start the cooks to do their work."

Starvation Conquered the City

Finally there was no work for the cooks to do. Supplies ran low, and people were put on half-rations. The horses and mules in the city were killed to supply meat, and men were dying of disease and starvation. When General Pemberton finally asked what terms would be given them, Grant replied with the same phrase which he had made famous the year before at the surrender of Fort Donelson: "Unconditional surrender." These hard terms Pemberton was forced to accept on July 4, 1863. Vicksburg had fallen; the Confederacy was divided; and the Father of Waters thenceforth "flowed unvexed to the sea."

Today Vicksburg is a thriving little city of cotton presses, oil mills, lumber mills, and miscellaneous manufacturing and shipping interests. Its military cemetery is the chief evidence of the former great struggle. Population, about 18,000.

VICTOR EMMANUEL II, KING OF ITALY (1820–1878). "What my father has sworn I will maintain," declared the young king of Sardinia-Piedmont, Victor Emmanuel II, when he ascended the throne after the disastrous defeat of Novara in 1848. This meant that he refused the inducements which victorious Austria offered him, and that he would continue the newly adopted constitution of his kingdom and the tricolored flag, emblem of the hoped-for Italian unity. This attitude won for Victor Emmanuel the title *Re Galantuomo*—the "Honest King"—and it rallied to his support all Italian patriots who longed to free their land from Austrian control and unite its numerous states into one.

It was a difficult task which Victor Emmanuel took up when his father Charles Albert abdicated, hoping that his son could secure better terms from the victorious Austrians following the unsuccessful revolution of 1848. The army was disorganized, the treasury empty, the people despondent. But the king was fortunate in securing the services of the statesman Cavour, and Cavour was fortunate in having as his king Victor Emmanuel.

Regardless of his personal inclinations, the king consistently supported his minister. Though a devout Catholic, he consented to the abolition of a large number of the monastic houses because he felt that it was for the good of the kingdom. He gave up Savoy, the cradle of his family, and the territory of Nice, to secure the indispensable aid of Napoleon III against Austria. And he sacrificed his own personal feelings to the good of his country when he consented to the marriage of his daughter to the dissolute cousin of Napoleon III as part of the price France demanded.

Only once did Victor Emmanuel fail to support Cavour. In 1859 when Cavour learned that Napoleon was abandoning his ally and withdrawing from the war before Venetia was freed from Austrian rule, he rushed to the king and wildly demanded that Sardinia continue the struggle alone. But Victor Emmanuel saw more clearly than his minister this time, and accepted—though with bitter regret—the peace of Villafranca.

Even so, the kingdom of Sardinia-Piedmont was increased by the conquered province of Lombardy. Then the states of Tuscany, Parma, Modena, and Romagna refused to take back their old autocratic rulers from whom they had revolted, and voted to become parts of the kingdom of Victor Emmanuel. On Oct. 29, 1860, Garibaldi, the knight-errant of Italian unity, handed over to the king Naples and Sicily, won by the valor of his army of "Red Shirts"; and on Feb. 18, 1861, a parliament proclaimed Victor Emmanuel II as "King of Italy."

Venice and Rome were still outside his kingdom. But these too were finally added—the one in 1866 and the other in 1871 (*see* Italy). Finally on July 2, 1871, Victor Emmanuel made his solemn entry into Rome, the Eternal City, which then became the capital of his kingdom. The union of Italy was complete. Although Mazzini, Garibaldi, and Cavour—especially the latter—contributed greatly to this result, it would have been impossible without the courage, patriotism, and absolute loyalty to his word of Victor Emmanuel, the "Father of his Country."

Victor Emmanuel III, the grandson of Victor Emmanuel II, came to the throne of Italy when his father King Humbert (1878–1900) was assassinated.

VICTORIA, AUSTRALIA. Though it is the smallest of the British states of Australia with the exception of Tasmania, Victoria has the second largest population. Its area of 88,000 square miles is somewhat less than that of Oregon, while its population of nearly 1,500,000 is nearly twice the population of Oregon. It is the greatest agricultural province of Australia, having seven times as much land under cultivation as Queensland, which is nearly eight times as large. Wheat and hay are the chief crops. As in the rest of Australia, sheep and cattle raising are the leading industries. Gold mining was formerly the greatest source of wealth but the production has greatly declined. Coal is mined in increasingly large quantities. Millions of acres of Victoria are so covered with forest-clad mountains as to be too wild for settlement but furnish an inexhaustible supply of the finest timber. The climate is fine, with a bracing, dry, pleasantly warm atmosphere. Snow has fallen only twice at Melbourne, though common on the higher plains and mountains. The chief cities are Melbourne, capital of the province (745,000); Ballarat, the center of one of the world's richest gold-yielding regions (40,000); Bendigo (36,000). The University of Melbourne is the leading institution of higher education. (*See* Australia; Melbourne.)

VICTORIA, BRITISH COLUMBIA. The traveler who lands at Victoria, capital of British Columbia, might well believe himself to have been dropped by mistake at a seaport in England. The people are chiefly of British descent, and they have built for themselves a city that recalls the beauties of the motherland, with neat homes and gardens bordered by precisely clipped hedges, with substantially built shops and offices, flowers blooming everywhere, and even the massive sea-walls overgrown with ivy. The climate, too, is like that of southern England, cooled in summer and warmed in winter by the ocean breezes, with a plentiful rainfall that keeps the abundant vegetation green all year long.

A large proportion of the population is made up of persons who have retired from active life and made their homes in Victoria because of its delightful climate. Many are retired naval officers who learned to love its leisurely life when the headquarters of the British Pacific squadron was at Esquimalt, three miles west.

The quiet conservative tone of life in Victoria contrasts strongly with the busy scenes in the broad harbor. For lying at the southeast end of Vancouver Island (*see* Vancouver) it is the Pacific gateway to Canada. There is scarcely an hour of the day or night that some ocean liner from a distant port or some

coastwise steamer does not come to port. East meets West in its streets, especially in the district known as "Chinatown," and thousands of Orientals—Chinese, Japanese, and Hindus—have become part of its population. Many Chinese are employed as house servants. For years the Asiatic influx was so great that the bars were put up to limit immigration.

Victoria's prosperity is chiefly due to its position as the capital and most desirable residential city of British Columbia, though it also ranks as one of Canada's great commercial centers by reason of its shipping and the lumber, mining, salmon-canning, and fishing industries which focus here. Its chief manufactures are ships, hardware, furniture, machinery, and biscuits. The splendid gray stone Parliament buildings are the city's most notable architectural feature.

The nucleus of the present city was Fort Victoria, established in 1843 by the Hudson's Bay Company as a trading post. It leaped into prominence with the gold rush of 1858, when thousands of fortune hunters poured in; it was incorporated in 1862 and became the capital of British Columbia in 1868. Population, about 40,000.

QUEEN VICTORIA
On Britain's Throne for 64 Years

Victoria, Queen of Great Britain and Ireland (1819–1901). The late Queen Victoria was the daughter of the Dowager Princess of Leiningen and the Duke of Kent, brother of William IV. At her birth there were five persons between her and the throne, but they all died before she came of age. She was brought up quietly by her German mother, but was carefully instructed in the languages, in history, and in government. Sir Walter Scott saw her when she was nine years old and remarked, "This little lady is educated with much care and watched so closely that no busy maid has a moment to whisper, 'You are the heir of England'." From the time she was 14 she was taken around to the country houses of the nobility. She proved a very charming young woman, simple-hearted, lively, self-possessed, fond of music and dancing.

When she was 18 (in 1837), her uncle William IV died. She received the news of her accession with great calmness. Being a woman she could not succeed to the throne of Hanover, which had been under the same sovereign as the British dominions since the accession of George I in 1714, and this passed to the nearest male heir. Of Victoria's first meeting with the Privy Council, the Duke of Wellington said: "She not merely filled her chair, she filled the room." Of her speech opening her first Parliament, Charles Sumner, who was visiting from America, said: "Her voice was sweet and finely modulated. I think I have never heard anything better read in my life."

The young queen had been brought up in a very "low church" or evangelical fashion, and she established at once something new in court life, for a high standard of morals and behavior was expected from everyone connected with the court. She had a great deal to do with fixing upon England that spirit of reticence and sober morality which has come to be known as "mid-Victorian."

It was fortunate for her that her first prime minister was the Whig leader, the Earl of Melbourne, for he took great pains with her political education and played the part of a prime minister, father, and private secretary to the inexperienced young woman. From the first the queen was inclined to emphasize the power of the sovereign, but she was slowly led to see that as a constitutional sovereign her real political influence was very small, and she must follow the advice of her ministers.

Two years after her accession she married her first cousin Prince Albert of Saxe-Coburg, one of the smaller German principalities. The match had been suggested some years earlier by her German relatives and advisers, but was finally settled at the queen's instance, who asked her cousin to marry her. It proved a marriage of love on both sides. He was a man of the highest character, devoted to art, music, and literature, and his influence on affairs was almost wholly good. The queen was able not without pressure to have her husband made "Prince Consort" and she always insisted upon his having a part in the government, a course which provoked criticism from many of her subjects. She looked up to him, counted him her chief adviser and private secretary, resented criticism of him, and after his lamented death in 1861 spent the remaining 40 years of her life in mourning him. Nine children were born of the union. In the bringing up of those children, in their illnesses, in their marriages and offspring, the queen found the chief interests of her life, together with her interests in her many German connections. But this is not to say that she neglected affairs of state. She gave time every day to them, demanded that all dispatches should be laid before her, read everything, and was eager to do her part. She was much interested in foreign affairs, but her notion of foreign policy was one that would benefit her many German relatives. She had dynastic conceptions of statecraft. Her foreign ministers were inclined as tactfully as possible to neglect and ignore her advice, and Lord Palmerston in particular, when foreign secretary, received several severe rebukes from her because he followed his own policies without heeding her opinions, and when he persisted was finally forced to resign.

Queen Victoria disliked life in London; she took great pleasure in Balmoral, a place she obtained in the Highlands of Scotland, and spent much time there and at Osborne on the Isle of Wight, as well as at the royal palace of Windsor. She was seldom in London more than a day or two at a time. After her husband's death she went into seclusion for years and refused to appear in public.

She made no effort to remain impartial as between the two political parties. In her earlier years as ruler she was a strong Whig, because of her friendship for Lord Melbourne. In her later years she was greatly fascinated by Disraeli, the Tory or Conservative leader, who deferred to her and cultivated the art of pleasing her. In 1876 he obtained the passage of a bill through Parliament conferring on her the title "Empress of India," largely to impress her subjects. His fall from power in 1880 was a hard blow to the Queen; she never concealed her dislike of Gladstone, and kept up a secret correspondence on state affairs with the fallen minister. In her later years too she pressed her foreign policy in support of the Turks against Russia even to the verge of war. She became indeed a thorough-going imperialist and was eager to see England take the aggressive rôle which she had rebuked Palmerston many times for pursuing. She would have stretched her prerogative very far; when she had to choose Liberal (Whig) ministers she went out of her way to snub Gladstone. She insisted too on her personal right of appointments to church offices, and had her way many times, exercising often great favoritism. After Disraeli's death she looked to Lord Salisbury and to Joseph Chamberlain as her favorite political advisers.

Victoria reigned longer than any other sovereign in English history. She was 82 years old when she died, had ruled 64 years, and retained her powers until nearly the last week of her life. She was quite unwilling to allow her eldest son, the Prince of Wales, to act in any of her capacities, and kept him as far as possible out of public life, even though he was a man nearly 60 when she died.

Victoria was a good woman, conscientious and highminded; but not clever nor even very wise. She was a bundle of prejudices, but she played her part as sovereign fairly well. On the whole her reign points the danger of the system of monarchy in modern politics; dynastic conceptions and relationships should have no part in modern diplomacy or state policy.

VICTORIA FALLS. This mightiest of all waterfalls in the world is situated in Rhodesia, British Africa, at a point where the Zambezi River passes from the central African plateau to lower levels. Its roar is like continuous thunder, and the vapor from the falling waters rises in a column that can be seen for miles. The native African name for the falls is "Thundering Smoke" (*Musi-oa-tunya*). We can imagine the sensations of awe and exultation with which Dr. Livingstone, the first white man to view it, gazed in 1855 upon this mighty spectacle.

VICTORIA FALLS, THE MIGHTIEST CATARACT IN THE WORLD

Nearly twice as high as Niagara Falls, the falls of the Zambezi River are the greatest spectacle of the kind in the world. They were named in honor of Queen Victoria by David Livingstone, who discovered them in 1855.

The height of Victoria Falls is over twice that of Niagara. It is divided by islands into four separate cataracts, of which the middle two, Main Fall and Rainbow Fall, are the widest. Their breadth together is slightly greater than that of the Horseshoe Fall and American Fall of Niagara, and the total breadth at the edge is considerably over a mile. The river pours perpendicularly into a deep chasm or crack in the earth, set squarely across the current, from which it issues roaring and boiling, the whole volume pent up and confined in a narrow gorge leading to a Z-shaped canyon. The Cape-to-Cairo Railway, which since 1905 enables visitors to reach the spot, crosses the canyon so close to the falls that passengers are wet with the spray. A hotel has been erected for the accommodation of visitors, and projects are under way for utilizing the enormous water-power.

VICTORIA NYANZA. In 1858 the English explorer J. H. Speke, seeking for the sources of the Nile, discovered this great body of fresh water and named it Victoria in honor of the queen of England. (*Nyanza* is merely the native word for "lake.") By further exploration he was able to prove that this was indeed the long-sought "birthplace" of the elusive Nile. But the lake itself remained pretty much a mystery until Henry M. Stanley, in 1874, braving its unknown waters and sudden and violent storms, sailed around it and found how vast was its extent. It is more than 200 miles long, its average breadth is 150 miles, and its area about 26,000 square miles—more than that of New Hampshire, Massachusetts, and New Jersey combined. It is exceeded in size among freshwater lakes only by Lake Superior.

Victoria Nyanza lies midway between British East Africa and the territory which was formerly known as German East Africa. Many steamships today ply across its waters, connecting Entebbe and other ports on the western shore with Port Florence on the east, the terminus of the Uganda railway which runs to the seacoast. There are many islands, most of them densely forested, and the coast-line is varied. The Kagera in the west is the principal feeder of the lake, and this river may therefore be regarded as the most remote headstream of the Nile.

VIENNA (*vē-ĕn'nȧ*), AUSTRIA. Once the capital of one of the greatest states of Europe, now a head without a body, capital of a petty state, impoverished and distressed—this is Vienna. True citizen of the world, she has had her full share of both the joys and ills of life. Situated at the gateway between western Europe and the East, for 2,000 years she has taken her toll of the caravans of the nations to build a city that is neither eastern nor western, German nor Slav, but something of each.

More favored than most European capitals, when Vienna (called *Wien* in German) became a great modern city she found the space to erect her public buildings, palaces, and art galleries in the center of the city, and was able to continue her political, social, and business life where it had come and gone for centuries. The wall and moat that had protected the old city against her many foes gave way, in 1858, to the magnificent Ringstrasse which, with its two promenade walks, two carriage roads, a bridle path, and a tramway down the center, now marks the boundary of the "inner city." Along this street are the buildings for which Vienna is so justly famous. Nothing better shows her cosmopolitan spirit than her architecture. The stately Grecian houses of Parliament look out upon the lavishly decorated Gothic Rathaus (city hall), while near by is the university, a magnificent specimen of the Renaissance style. Strolling farther around this two-mile circle one passes the beautiful opera house, luxurious shops, the Academy of Art, which ranks as one of the finest galleries of the world, and the Hofburg. This is the famous Hapsburg palace, in reality a collection of buildings of various epochs built in various styles. In addition to the private and state apartments it contains a large library with many rare books and manuscripts.

In the narrow crooked streets of the inner city still lingers something of the spirit of the Middle Ages. The old buildings, many of them dating back to the 13th and 14th centuries, are little touched by modern hands. Chief among them is St. Stephen's Cathedral, from whose lofty tower the despairing Viennese scanned the horizon for the banners of Sobieski's army in 1683. Only a step away is the Graben with its smart modern shops, its banks, its gilded cafés, its crowds of shoppers, its coffee houses where for decades all Vienna could be seen drinking coffee and chatting at five o'clock in the afternoon. The café is the center of the social life. Each one has its own group; one is favored by merchants who come to discuss prices and transportation; at another you will find the leading actors and musicians immersed in the small talk of their craft. Perhaps the part the cafés play is so great because Vienna lives in apartment buildings; only the fortunate few live in houses.

A City Famous for Gaiety

Assuredly it was the street life that gave Vienna a distinctive charm in her golden days, when she was a city of gaiety, of life, of music, and of dancing. While the rich aristocracy rode leisurely up and down the Ringstrasse, the rest of Vienna promenaded along the margins. Merchants brought their families for a treat, vividly uniformed officers loitered about; there were students from the university, music students from the ends of the world, nursemaids with their tiny charges, and everywhere the beautiful Viennese women. In the people's playground, the court garden near the Hofburg, all day long the benches were filled with the good-natured, frank Viennese, always cordial to the stranger, seemingly always happy. On Sundays and holidays crowds of merrymakers flocked to the Prater, a beautiful 2,000-acre park which stretches from the Danube Canal on its western edge, along a tiny section of the Ringstrasse, to the Danube itself, which is a mile away from the city proper. Here were theaters, circuses, menageries, restaurants,

music everywhere, and dancing all day long. The Prater, which was once an imperial deer-park, is really a huge island, about four miles long and two wide, beautifully laid out and adorned. There are several other spacious parks, in addition to a great extent—more than 50 per cent of the total area of the city—which is occupied by private gardens, woodland, or cultivated land.

Vienna is the cultural as well as the political capital of Austria. In architecture and art she has reached the heights, but true to her cosmopolitan taste she preferred to choose the best from the work of other nations, rather than develop a school of her own. Her music has been her special forte; Haydn, Mozart, Beethoven, Schubert, and the waltz king, Johann Straus, are some of her gifts to the world.

In her industries also Vienna displayed her artistic skill. All the world knows the fame of the jewelry and articles of precious metals her artisans have wrought, her leather goods, musical instruments, optical goods, and furniture. Other manufactures are machinery, railway engines and carriages, textiles, and chemicals. For communications the city has, besides the Danube River, railroads that radiate in every direction, making it an important distributing center for corn, flour, cattle, wine, sugar, and a large variety of manufactured goods.

TRINITY COLUMN, IN THE GRABEN

This monument, 69 feet high, which stands in the center of Vienna's shopping quarter, was erected in 1693 to commemorate the cessation of the great plague of 1679. From the three-sided base rises a column of clouds, with angels and cherubs leaning down above figures of the Holy Trinity. Public prayers are still held here on Corpus Christi Day.

The story of Vienna goes back to the early years of the Christian era, when Roman legions tramped into the little Celtic village of Vindomina on the Danube River, and there established a garrison to protect the frontier. Here Marcus Aurelius died in 180 A.D. Ere long the town was overrun with the barbarian hordes pouring down into the Roman Empire; Attila and his Huns tarried for a time on their way to the West. At the end of the 10th century "East Mark" emerged from the gloom of the Dark Ages and, in 1237, the city of Vienna received a charter of freedom from Frederick II. During the Crusades she prospered mightily from the traffic that flowed down the Danube, and grew to the size of the present inner city, but it was not until she became the capital of the Hapsburgs in 1276 that her real glory began. From then on the fortunes of the House of Austria were hers. For several centuries Vienna was the bulwark of western Europe against the Turk, and twice, in 1529 and 1683, she withstood severe sieges. It was during the second siege that John Sobieski and the Poles came to the rescue barely in time to save the city.

In 1814, the city was the scene of the Congress of Vienna (*see* page 1196), one of the most brilliant assemblages of monarchs and statesmen the world has ever seen, among whom Metternich, the master spirit of the Restoration period, was the leading figure. Here Alexander of Russia, Frederick William, Castlereagh, Talleyrand, and a host of lesser personages gathered to discuss and settle the problems arising from the Napoleonic wars. For months the Austrian capital was a whirl of gayety, and as many of the grave questions of diplomacy were settled over the banquet wines and in the intervals of the dance as around the council table.

In grim contrast to this brilliant scene was the aspect of Vienna at the close of the World War. The armistice of 1918 found her a city of shivering and hungry women, children, and old men; her streets were no longer thronged with gay coffee-drinkers, but with people who must walk to keep warm; the children were dying for want of food, and the whole population staring at starvation. The treaty of St. Germain left Austria stranded, her rulers overthrown, an island within a patchwork of rival states, without a seaport, isolated, ruined, hungry, hopeless; and the Vienna that had radiated the glory that was the Hapsburgs now shared the disaster of their downfall. Population, about 1,840,000.

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